Suffering from obesity

Wouters, E.J.M.

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Psychosocial aspects of assessment, treatment and aetiology

Eveline J. M. Wouters

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Suffering from obesity
Psychosocial aspects of assessment, treatment and aetiology

Lijden aan obesitas
Psychosociale aspecten van assessment, behandeling en etiologie

(met een samenvatting in het Nederlands)

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Universiteit van Tilburg, op gezag van de rector magnificus, prof. dr. Ph. Eijlander, in het openbaar te verdedigen ten overstaan van een door het college voor promoties aangewezen commissie in de aula van de Universiteit op woensdag 31 maart 2010 om 16.15 uur

door

Eveline Joanna Maria Wouters,

geboren op 15 januari 1958 te Eindhoven.

Promotores

Prof. dr. A.J.J.M. Vingerhoets
Prof. dr. R. Geenen

Promotiecommissie

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Prof. dr. L.P. Peeraer

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Chapter 1

General introduction

OBESITY: DEFINITION, EPIDEMIOLOGY AND AETIOLOGY

Obesity is a chronic health problem, characterised by an excess storage of fat. In adults Body Mass Index (BMI, weight in kilograms divided by squared height in meters) is often used to indicate healthy and unhealthy weight[1]. A BMI between 25 and 30 kg/m² is defined as overweight, and a BMI exceeding 30 kg/m² is defined as obesity. Obesity is further classified as class I (BMI 30.0 - 34.9 kg/m²), II (BMI 35.0 – 39.9 kg/m²) and class III (BMI 40 kg/m² or more)[2] obesity. Class III is also referred to as morbid obesity.

Obesity is considered a major health problem[3, 4], especially -though not exclusively - in wealthy countries[5]. At this moment at least 400 million adults worldwide are obese[6]. Since 1985, the prevalence of obesity in the United States has doubled, and nowadays about one third of American adults is obese[7]. Although less extreme, also in European countries the prevalence of obesity is high and in the Netherlands it is estimated to be between 10 – 12% of the adult population[8].

Obesity is not equally prevalent in nations[9]. Within nations also several disparities exist: in wealthy countries the prevalence of obesity is higher in people with a lower socio- economic status[10-12] and there are consistent racial differences[13, 14], also in the Netherlands[15]. Obesity is a relatively recent public health problem and there is no evidence that it will have reached its maximum in the near future[7]. Moreover, the increase in overweight and obesity during their lifetime seems to become more prominent in younger, as compared to older generations[16], also confirming that the obesity problem is still growing.

Generally obesity is regarded as the result of a disturbed balance between energy intake and energy expenditure. This is easily translated into considering obese persons as people who eat too much and exercise too little. Although this description is basically true, it oversimplifies the complexity of aetiological mechanisms underlying obesity. The truth is far more complicated and not yet fully understood. In addition to nutritional factors and physical inactivity, also genetic, hormonal, psychological, and socio economic factors should be considered in order to understand the global development of obesity[17].

In the obesity epidemic environmental factors are considered to play an important aetiological role. The easy access to unhealthy food and the decreased need for physical exertion, especially in neighbourhoods that obstruct physical exercise for being unsafe with respect to traffic or crime[18-22], have led to an almost inevitable energy imbalance and, together with many other factors at the micro- and macro environmental level, help to preserve the problem[23, 24]. In evolution, being able to store energy in periods of food scarcity used to be a favourable quality. Persons who survived were

likely to have and pass the so called 'thrifty genes'[25, 26]. Therefore, from an ecological perspective, obesity could be regarded as a normal response to an abnormal environment[27, 28].

When trying to understand the determinants in the aetiology of obesity, young people are a group of special interest. Overweight in adolescence often tracks into adulthood, causing a life long health problem[29]. In addition, as a result of rapid changes, e.g., in body composition[30] and social relations[31], many of the physical and psychosocial problems associated with obesity may develop in a relatively short period of time.

CO-MORBIDITY AND HEALTH RELATED QUALITY OF LIFE

Quality of life is a concept defined in many ways[32] and the definition to date is far from clear[33, 34]. Quality of life includes all domains important to a person, e.g., the physical, social, emotional, financial, educational, spiritual and environmental domains[32]. The concept of health-related quality of life addresses domains associated with disease and ailments. After health had been defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" by the World Health Organisation in 1948[35], there have been many attempts to define and measure health-related quality of life, with varying success. Partly because chronic diseases are accompanied by far more prevalent health problems than acute diseases, the need to regard health-related quality of life as an outcome of treatment has increased. Obesity impacts quality of life in both the physical, as well as the mental and social domains. Although quality of life and health-related quality of life are not synonyms, in this thesis, whenever the term 'quality of life' is applied, I refer to 'health-related quality of life'.

Whereas the aetiology of obesity is complex and not fully unravelled, the possible physical consequences for the individual have been mapped out quite detailed. Obesity is a risk factor for diabetes, cardiovascular disease, and several other complications of the metabolic syndrome, including sleep apnoea, gall bladder problems, poly-cystic ovarian syndrome, fatty liver and gout, as well as several types of cancer[3], orthopaedic complications, especially osteoarthritis[36], and overall morbidity and earlier mortality[37-39]. In general, there is an excess of unhealthy years lived in obesity, as compared to persons with a normal weight[40]. It is clear that obesity can result in decreased quality of life, as a direct and indirect result of these somatic problems.

The majority of obese persons have no overt psychiatric disorders[40, 41], but obesity is associated with several mental problems such as depressed mood and a low self-esteem[42, 43]. There is also growing

evidence that there is a connection between obesity and depression[44], and especially for adolescent girls, obesity is associated to current and later adult depression[45, 46], thus causing a severe impact on quality of life. The relation between major depression and obesity is especially strong in higher educated women, persons seeking obesity treatment, and in binge eating disorder[40, 41].

In addition to psychological problems, obese people may experience social problems such as bullying, stigmatisation and discrimination[47, 48], often from a young age onward[49, 50], and reduced chances for education and to find a job. Obesity is often perceived by the non-obese as something preventable and a consequence of one's own lack of self-discipline and motivation[51, 52]. Also family of the obese and health professionals in the obesity field may hold this belief towards obese persons[52-54]. Weight stigmatisation in children and adolescents has increased[55]. Adolescents, in particular girls, are often the victim of weigh stigmatisation[56], and the relation between weight status and depression in this group[45] may at least partly be explained by peer victimisation[57]. In many persons the origin of psychosocial health impairment as a result of obesity, thus originates early in life.

For the evaluation of the quality of life of obese persons, in addition to generic measurement instruments, some obesity specific quality of life instruments have been developed and validated[58]. These specific instruments have the advantage of a greater sensitivity to change, i.e., they reflect more accurately obesity related changes, e.g., as a result of interventions[59]. Most obesity specific quality of life instruments have been developed in the United States[3]. Until recently, no Dutch equivalents were available for research and clinical application. There is still a need for the development of such instruments, especially for the younger age groups.

In summary, quality of life is reduced in obese persons, both in the physical and psychosocial domains, even in persons not suffering from obesity related physical co-morbidities[60]. Therefore, when evaluating interventions, the assessment of quality of life is mandatory and there is still need for specific obesity related quality of life instruments.

TREATMENT OF OBESITY AND THE SPECIAL ROLE OF PHYSICAL ACTIVITY

Many obese persons do not seek medical treatment, but if they do, most of them are motivated because they suffer from co-morbidities or otherwise reduced quality of life in one or more domains[61, 62].

Conservative treatment of obesity for the individual patient mainly consists of the combination of reduced caloric intake, enhanced physical activity and (psychological) support for lifelong lifestyle changes[63]. For morbidly obese patients these treatments do not suffice, and for them bariatric surgery is currently the most successful treatment option[64]. Compared to less overweight persons or persons conservatively treated, in morbidly obese patients seeking surgical treatment, quality of life is most severely reduced[62], and the changes after treatment are most striking. Bariatric surgery reduces weight and co-morbidities[65], and improves quality of life in all domains[66, 67]. But also after surgery, lifestyle changes remain necessary, and patients will need support to maintain the good results[68-70].

Physical activity is part of nearly all obesity intervention programmes. There are several good reasons for including physical activity. Physical activity alone can be an effective strategy for weight reduction[71, 72]. Moreover and also measurable after a period of performing less strenuous forms of exercise, physical activity can contribute to the preservation of diet induced weight loss[73, 74]. For this reason the role of physical activity programmes in multidisciplinary obesity intervention programmes has been firmly established. Not only weight is favourably influenced by physical activity. Independent of its effect on weight, physical activity can reduce the risk for somatic co-morbidities of obesity such as cardiovascular and metabolic disorders[74-78]. In addition, important effects on the mental and social domains of quality of life have been reported as a result of exercise. After physical exercise programmes, more self-esteem, less depression, improved appreciation of one's body and, in general, better quality of life have been demonstrated[79-84].

However, these obvious advantages of physical activity in research have not resulted in the widespread engagement in sportive activities or otherwise reduction of the sedentary lifestyle of obese persons[85]. It is hard to motivate overweight and obese people to exercise and the dropout rate in physical activity programmes for overweight persons is high[86]. The exact mechanisms underlying this lack of motivation and compliance are not fully understood. More knowledge of these mechanisms can contribute to more successfully addressing the sedentary lifestyle of this group.

AIM AND OUTLINE OF THE THESIS

This thesis addresses psychosocial aspects of the assessment, treatment, and aetiology of obesity, with special focus on quality of life. The successive parts of this thesis describe three lines of research with different research questions.

In the first part (chapters 2, 3, 4 and 5), the focus is on assessment of quality of life and suffering in obesity. Chapter 2 is a literature review with the aim to examine the concept of quality of life in the context of the bariatric patient. In chapter 3, a meta-analysis of literature is described examining differences in baseline health-related quality of life between seekers of surgical treatment, seekers of non-surgical treatment, and non-treatment seekers, and the role of weight, age, and gender in the associations between quality of life and treatment status. Chapter 4 presents a feasibility study of a pictorial assessment instrument, which measures suffering (Pictorial Representation of Illness and Self Measure, PRISM). Different patients groups participated in this study. One of the study groups consisted of morbidly obese persons seeking bariatric surgery. This study was designed to investigate the content validity and the convergent and divergent construct validity of the Self-Illness Separation (SIS) and the Illness Perception Measure (IPM), the two PRISM variables that quantify suffering. The purpose of chapter 5 is to evaluate the psychometric qualities of the Dutch translation of the Impact of Weight on Quality of Life-Kids (IWQOL-Kids), a measure to assess the bodyweight related quality of life in adolescents (age 11 – 19 years). The overall aim of part I of this thesis is to review and develop new measurement tools to assess obesity related quality of life and suffering.

The second part of this thesis (chapter 6, 7, 8 and 9) examines the association between quality of life and physical activity, and focuses on psychosocial factors influencing physical activity in obesity. In order to better be able to incite overweight persons to enter an exercise programme, the aim of chapter 6 is to identify the possible factors that prevent people from starting a physical exercise programme. In this chapter the role of health beliefs in the motivation for overweight adults to start physical activity is examined. Chapter 7 aims at gaining knowledge on the predictive value of obesity related quality of life and suffering for dropout of obese persons from a physical training programme. We hypothesise that more suffering and poorer quality of life predict risk of dropout. In chapter 8 a pilot study is presented that examined the safety and potential effectiveness of a six-week aquajogging exercise programme on body composition, aerobic fitness, and health-related quality of life in obese people. In chapter 9, the effect of surgery on physical exercise and exercise beliefs in a group of bariatric patients is evaluated. It is hypothesised that exercise cognitions

change favourably as a result of bariatric surgery, and that negative perception of exercising predicts less physical activity. In summary, the second part of this thesis seeks to uncover the relationship in obesity between psychological and quality of life related factors on the one hand, and physical activity on the other hand.

In order to find factors important for the aetiology of the obesity epidemic, the third part aims to lift out obesity from the individual level, by also focusing on environmental factors. Adolescents were chosen as study subjects, because the rapid physical (e.g., hormonal) and emotional (e.g., depressive mood) changes, as well as changes in the social (e.g., peer groups) and physical (e.g., school) environment, can offer clues towards aetiological contributors of obesity. In chapter 10, the association between body weight and depressive symptoms in adolescent girls is related to physical pubertal changes. In chapter 11, the focus is on the social and physical environment. The aim of this study is to find how the social and physical environment of adolescents are involved in snacking, one of the behaviours related to obesity.

The results of all three parts are discussed in chapter 12, including the clinical application of the results and indications for future research. Chapter 13 summarises the thesis, and chapter 14 offers a brief overview of thesis and author.

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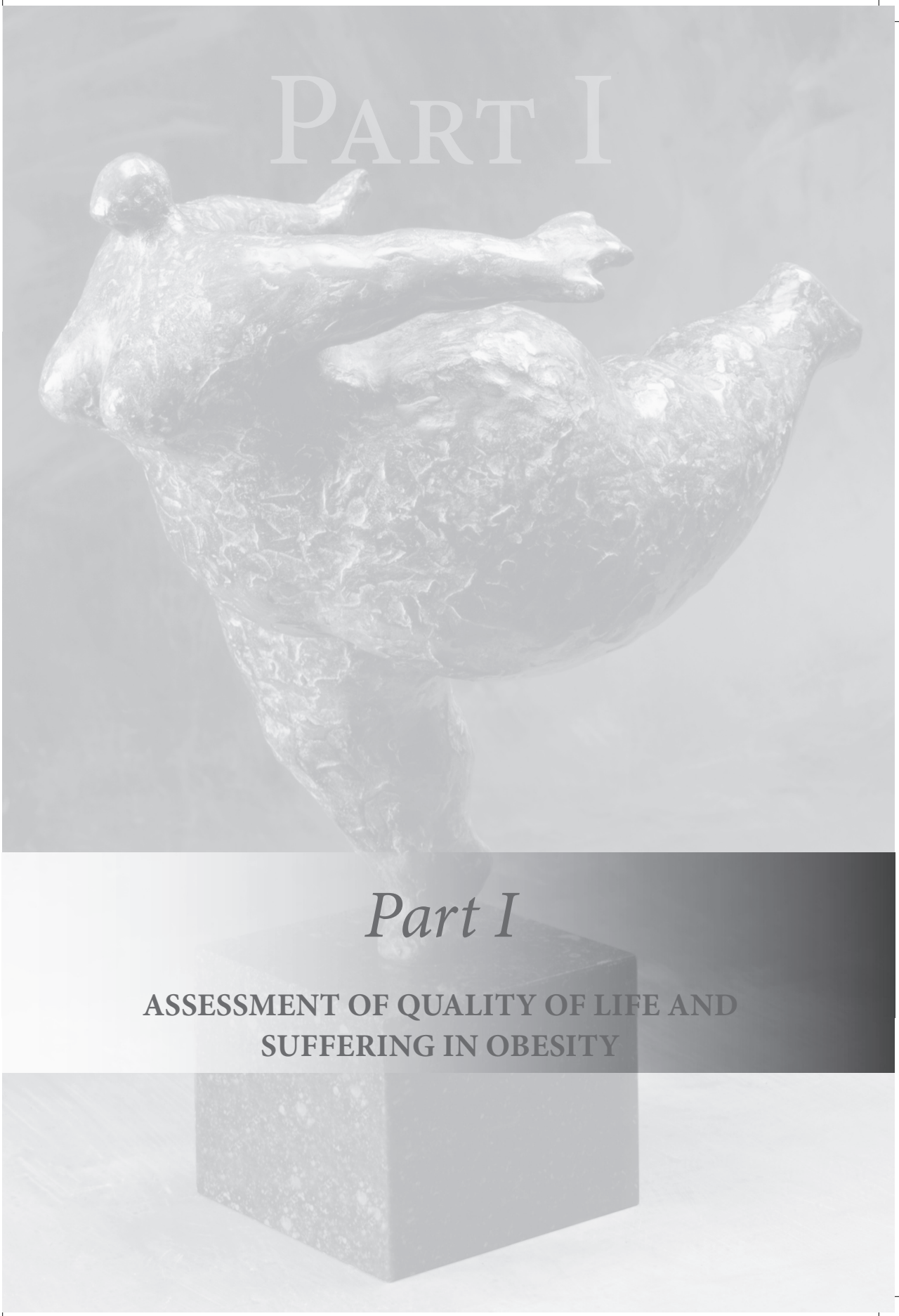

Part I

ASSESSMENT OF QUALITY OF LIFE AND SUFFERING IN OBESITY

2

Chapter 2

Quality of life before and after bariatric surgery: a review

Wouters EJ, Geenen R. Quality of life before and after bariatric surgery: a review. In: Rogers J, ed. Gastric bypass: surgical procedures, health effects and common complications. Hauppauge, NY: Nova Science Publishers. In press.

ABSTRACT

Obesity, especially morbid obesity, is a major health problem with considerable impact on physical, mental and social quality of life. Assessment of quality of life is considered crucial to understand and evaluate the consequences of obesity. However, the heterogeneity of the quality of life concept makes it difficult to compare and value studies on quality of life. Both generic -applying to any disease- and obesity specific quality of life instruments can be used as assessment instruments in obesity. Generic instruments have the advantage that they can be used to compare the quality of life consequences of divergent diseases, whereas the major advantage of obesity specific instruments is that these are more sensitive to changes in obesity. Obesity has major consequences for quality of life, as a result of co-morbidities of obesity, weight stigmatisation, and other less frequently ventilated problems. Bariatric surgery has been proven to lead to significant weight loss and improvement of quality of life. Instruments differ in the suitability to assess quality of life after surgery and weight loss, and they differ in the domains of quality of life that are tapped by the instruments. Besides obesity, also personal and psychosocial variables influence quality of life and affect the outcome of surgery. Obesity, even after substantial weight loss by gastric bypass surgery, is a chronic disease requiring life long consideration, in order to attain long standing quality of life improvement.

INTRODUCTION

Obesity, especially morbid obesity, is a major health problem with considerable impact on physical, mental and social quality of life. Morbidly obese persons report problems with their mobility and activity level, vitality, social relations, eating behaviour, and sexual life[1]. A higher body weight is associated with proportionally reversed quality of life[2, 3]. Of all obese groups, women seeking bariatric surgery report the lowest quality of life and surgery is often the last resort for patients after many attempts to lose weight with dietary therapy[4]. Patients mention several reasons to apply for surgery; many of them are related to co-morbidity and experienced restrictions in several domains of quality of life[5, 6]. Thus, quality of life is an important issue for obese people who seek surgical treatment. Divergent quality of life domains have been widely accepted as health outcomes after bariatric surgery, next to co-morbidity and weight loss.

Quality of life often improves considerably after bypass procedures[7, 8] and most patients are satisfied with the results several years after surgery. Some specific problems, such as binge eating and skin abundance after treatment, might negatively impact on quality of life and need attention in order to improve the results.

In this chapter first the historical background and definition of quality of life will be reviewed. Different quality of life definitions are often used interchangeably. The ways to assess quality of life will be described, with a focus on generic -applying to any disease- versus obesity specific instruments, including the applicability of the most frequently used instruments. An overview will be given of aspects of quality of life in the obese patient, and factors that moderate the extent to which patients tend to suffer. Quality of life outcome after surgery and the relative importance of psychosocial determinants, and special issues relevant for long term results, are discussed. Finally, some future challenges will be presented.

HISTORICAL BACKGROUND AND DEFINITION

In 1948, the World Health Organisation gave a strong impetus to the quality of life concept by stating that “health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”[9]. The statement induced discussions on the best way to measure health in practice. By defining health not merely as the absence of disease, but in a more positive manner, the focus of health shifted to the subjective perception of health. This implies that

conventional health measurement instruments that assess presence or absence of disease and disease signs no longer suffice. Another consequence is that to get a full picture of someone's health, not only disease, but also the person's response to the disease is important. Here illness rather than disease is a more appropriate word to be used. Illness also includes the perceived part of health. Both mental and social determinants and consequences play a role in the new health concept[10].

Along with the implementation of the new health concept in clinical practice, the International Classification of Diseases (ICD) was complemented with the International Classification of Impairments, Disabilities and Handicaps (ICIDH, developed in the eighties) and the more recently and more positively formulated International Classification of Functioning, disability and health (ICF, 2001)[11].

Quality of life as an outcome measure in medical literature has been gaining more popularity due to several reasons, among others to oblige to the desire to incorporate the perspective of the patient in therapies such as chemotherapy, which put a high load on patients. This eagerness brought about the construction of numerous so called quality of life measurement instruments. These instruments mostly are not based on a uniformly and clearly defined concept of quality of life. This problem can be partly attributed to the simultaneous occurrence of two separate lines of development which have influenced the concept. First, form a medical line of history, the concept of quality of life was derived from the *functional health status* concept. A patient's daily behaviour and activities were added to the strictly biological assessment of the patient[12]. A list of impairments, disabilities and handicaps was developed, resulting in the ICIDH. Second, from a psychosocial science point of view, quality of life was related to psychological and environmental factors. Public life determinants, such as education, employment, security, and neighbourhood were appraised as indicators of quality of life in this perspective[13].

These separate lines of development are to date still reflected in the absence of a uniform definition of quality of life[14]. In literature, depending on the scope of the researcher or clinician, the full range of 'health status' and 'happiness' up till multifaceted domain models, can be encountered as definitions of quality of life. This makes it difficult to compare the studies. Some definitions are too parsimonious to do justice to the threat to quality of life that is experienced by the patient. Other definitions include as many domains as physical health, mental health, extent of independency, social relationships, and sometimes also the environmental and spiritual domains[15, 16]. Some stress that the perspective of the patient, i.e. the extent to which the patient values a specific position in life regarding the context and everything that is considered important is core to the evaluation of quality

of life[15, 16]. A brief straightforward definition of quality of life then is that it is a personal perception, indicating how a person feels about his or her health status including nonmedical aspects of life[17]. In conclusion, the heterogeneity in quality of life concepts may lead to confusion of tongues. For understanding and rightly valuing research on quality of life with respect to obesity, the heterogeneity of definitions has to be born in mind. However, it is impossible to think about interventions nowadays without considering quality of life. The last four decennia have shown a shift from the biomedical into the biopsychosocial model of health and disease[10]. A great number of assessment instruments have been developed, many generic, and some especially designed for obesity. Taking the shortcomings into account, the introduction of these measurement instruments has added to the understanding of patients' position and perspectives in medicine.

ASSESSMENT OF QUALITY OF LIFE

Assessing quality of life is important from both a clinical and a scientific point of view. It is important from a clinical perspective, because of the increasing prevalence of chronic diseases due to aging, and because diseases that used to be fatal such as myocardial infarctions, cancer and HIV, have better treatment options. To improve the match between the care that is given and the care that is needed, quality of life aspects can be guiding. Also in research, not only the biomedical outcome, but also quality of life and improvement of quality of life, have become established as outcome measures.

Quality of life measurement instruments can be roughly divided into generic and disease-specific instruments. Sometimes domain-specific questionnaires are used, for instance instruments that predominantly apply to the physical domain. Generic instruments are multi-dimensional and can be used in different patient groups, with different health problems, different interventions, and demographics[18]. By using generic instruments, comparisons of the relative burden of disease can be made between diseases and interventions. These instruments may lack the sensitivity to demonstrate characteristic aspects of certain diseases. An example of such a generic quality of life questionnaire is the World Health Organisation Quality of Life assessment instrument (WHOQOL-100)[19]. Another widely used instrument, the Medical Outcomes Study (MOS) Short Form (SF-36)[20] is also often categorised within this group, although it has been argued that this questionnaire actually measures health status[21]. This instrument asks about health themes, but does not explicitly ask the patients how they personally value these adverse consequences of

health for quality of life.

Disease specific instruments are developed to measure quality of life in specific patient groups. They focus on problems that are common or specific for certain diseases. The disease specific and the generic instruments can, as a result of their different focus, give different results in the same patients. The disease specific measurements are, compared to generic instruments, better able to evaluate subtle changes due to alterations in the course of the disease, they tend to react more promptly when successful interventions are given, and are able to discriminate within subgroups of a population with a specific disease, e.g. between obesity groups that differ in body weight or clinical versus general population groups of obese persons. A drawback of the use of disease specific instruments is that comparison with other disease groups is impossible and the instruments may fail to assess valuable aspects of quality of life in the lives of individual patients.

In the evaluation of quality of life in obesity, the diversity of measurement instruments used in different studies should be considered[22]. For instance, when using generic instruments, most studies find an association between body weight and physical health, but not between body weight and mental health[23, 24]. Weight related measurements on the other hand, are also able to discriminate on the emotional and social domains, as well as on physical functioning between groups with different body weight[3, 25, 26].

Because generic and disease specific scales are complementary, it is useful to use both types of instruments, in order to be able to make comparisons across different populations and at the same time to discriminate within the disease population of interest[27].

In studies of obesity, a large variety of measurement instruments have been used to assess the relationship between obesity and quality of life. Some of the commonly applied generic and weight-related instruments will be presented.

Generic instruments

The generic instrument most often used in obesity studies, is the SF-36 questionnaire[20]. This instrument, with 36 questions, consists of eight scales. These are: physical functioning, role limitations as a result of physical health, role limitations due to emotional health, bodily pain, general health, vitality, social functioning, and mental health. The scores on each scale are transformed to scores from 0 till 100, and to two summary scores, a physical component summary score and as a mental component summary score. The SF-36 is widely used, which is mainly because the access is easy and for free, and the questionnaire has been translated and validated in many languages and for several diseases[28, 29]. In table 1 example questions and answering categories from each

scale of the SF-36 are presented. An abbreviated version of the SF-36, the SF-12, also captures the eight domains and both the mental and physical summary scores of the SF-36. In obesity, this easily applicable instrument has proven to be reliable, and even better able to measure differences in quality life as related to body weight compared to the SF-36[30].

Table 1. Example questions with answering categories from each scale of the SF-36

Scale	*Example question*	*Range and number of answering categories (n)*
Physical functioning	Climbing several flights of stairs?*	Yes, limited a lot – No, not limited at all (3)
Role limitations due to physical health	Cut down the amount of time you spent on work or other activities?**	Yes – No (2)
Role limitations due to emotional problems	Didn't do work or other activities as carefully as usual?**	Yes – No (2)
Bodily pain	Did pain interfere with your normal work?**	Not at all – Extremely (5)
General health	I am as healthy as anybody I know	Definitely true – Definitely false (5)
Vitality	Did you have a lot of energy?**	All of the time – None of the time (6)
Social functioning	How much of the time has your physical health or emotional problems interfered with your social activities?**	All of the time – None of the time (6)
Mental health	Have you felt so down in the dumps that nothing could cheer you up?**	All of the time – None of the time (6)

*perceived limitation during a typical day
**perceived problems or limitations during the past four weeks

Another instrument, designed for measurement of generic quality of life, is the WHOQOL-100, which measures six domains of quality of life, i.e., physical health, psychological health, independency, social relations, environment, and spirituality/religion or personal beliefs. The WHOQOL-100 has good psychometric properties[19]. Example questions with the range of the answering categories are shown in table 2. All questions have five answering categories. Because of its length a short form version has been developed, the WHOQOL-BREF, a 26-item questionnaire covering four

domains: physical, psychological, social relations, and environment. Scores range from 0 to 20. The WHOQOL-BREF is reliable and valid across cultures and in clinical samples[31]. The WHOQOL questionnaires, compared to e.g. the SF-36, explicitly include the patient perspective in the questions by asking how satisfied the respondent is with certain aspects of health.

Table 2. Example questions with answering categories from each domain of the WHOQOL

Domain	*Example question*	*Range of answering categories*
Physical domain	How much do you worry about your pain or discomfort?	Not at all – An extreme amount
Psychological domain	How much do you enjoy life?	Not at all – An extreme amount
Level of independence	How much do any difficulties in mobility bother you?	Not at all – To an extreme amount
Social relations	How satisfied are with your personal relationships?	Very dissatisfied – Very satisfied
Environment	How available to you is the information you need in your daily life?	Not at all - Completely
Spiritual domain	To what extent do you feel your life to be meaningful?	Not at all - Extremely

The EQ-5D is an instrument less frequently used, and is rating health in the dimensions mobility, self-care, usual activities, pain and discomfort, and anxiety and depression[32, 33]. The domains that are assessed by this instrument are closely related to health status.

Another instrument that might be considered to assess quality of life, is the Pictorial Representation of Illness and Self measure (PRISM)[34-36]. The instrument measures the burden imposed by disease and can be used for several health problems, including obesity. The instrument consists of a white rectangular sheet of firm paper, on which a circle is depicted, representing the patient's current life. In the centre of this is a yellow circle, representing one's 'self' (figure 1).

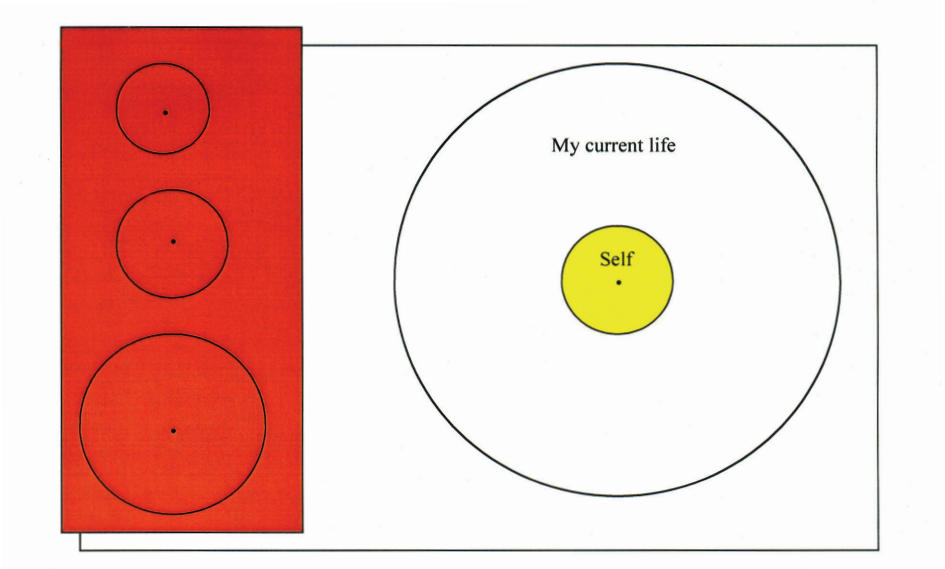

Figure 1. The Pictorial Representation of Illness and Self measure (PRISM); The outer circle represents one's current life, the yellow circle represents one's self, the red circles represent possible representations of the medical problem.

The patients imagine themselves as the yellow circle and are asked (with a standard oral or written instruction) to stick one of three different sized red (adhesive) disks, representing their illness (e.g., obesity), somewhere on the white sheet of paper. Also, they are asked to communicate why they chose for a particular size and position, thus eliciting qualitative information on the problem. A greater distance between the yellow circle and the illness-disk is hypothesised to represent less suffering, and a higher size of the illness-disk to indicate a greater perceived severity of the illness[37]. There is preliminary support for the feasibility and validity of the variables assessed by the PRISM in measuring aspects of suffering[37]. The strength of this instrument is that is assesses overall suffering and that the instrument offers the possibility to start a conversation with patients on relevant aspects of their illness. Further evaluation for the use in bariatric surgery patients is recommended.

Weight specific quality of life instruments

Several weight specific quality of life instruments have been developed in different settings. A selection will be presented.

The Impact of Weight on Quality Of Life[38], short version (IWQOL-Lite)[39] includes 31 items and

five scales on physical function, self-esteem, sexual life, public distress and work. In table 3 example statements with corresponding answering categories are presented. All questions have five possible answer categories. The IWQOL-Lite is a reliable and valid instrument in both clinical and community samples[39, 40] and can discriminate between obesity subgroups[39-41]. Translations in several languages are available[42] as well as a validated version for adolescents between 11 and 19 years of age[26]. The IWQOL-Lite is often used together with generic instruments, such as the SF-36.

Table 3. Example statements with answering categories from each domain of the IWQOL-Lite

Scale	*Example question*	*Range of answering categories*
Physical function	Because of my weight I have trouble using stairs	Always true – never true
Self esteem	Because of my weight I don't like myself	Always true – never true
Sexual life	Because of my weight I do not enjoy sexual activity	Always true – never true
Public distress	Because of my weight I experience discrimination by others	Always true – never true
Work	Because of my weight I am less productive than I could be	Always true – never true

The Obesity-Related Problem Scale (OP) was developed for the Swedish Obese Subjects (SOS) study[43]. The aim of the instrument is to assess effects of obesity and long term effects of weight loss on psychosocial functioning in everyday life. The scale has eight items, asking about how much patients are bothered by certain everyday activities, such as swimming in public places and trying and buying clothes. The OP is psychometrically valid and responsive to weight change in several interventions, including surgery[44-46]. Strong points of the instrument are the user friendliness, and the explicit focus on the patient's evaluation of obesity specific situations. Weaknesses are the narrow focus on social situations, and that the scale has not been widely used outside the SOS study[47].

The Obesity Specific Quality of Life (OSQOL) scale is specifically developed for the French population[25]. This is an 11-item scale with four dimensions: physical state, vitality, relations with

others and psychological state. The psychometric properties of this instrument were found to be satisfactory[25]. The instrument has not been thoroughly tested on its responsiveness and little information is available as on interpretation of the scores[48].

For bariatric surgery patients, a specific instrument has been developed: the Bariatric Analysis and Reporting Outcomes System (BAROS)[49, 50]. This instrument evaluates the result of obesity treatment on quality of life (using the Moorehead-Ardelt questionnaire[51]), but also on percentage of weight loss and co-morbidities. The instrument also reports on surgery complications and re-operations[50]. The quality of life assessment instrument consists of six questions, with a 10-point Likert scale scoring key[50].

Although there are several other obesity specific quality of life instruments available, most of these have not been extensively evaluated in bariatric surgery patients. An overview of instruments has been given[48].

QUALITY OF LIFE IN THE OBESE PATIENT

The body of evidence in literature indicates that obesity is related to a lower (health related) quality of life. It has been frequently shown that obesity is associated with decreased vitality and physical, sexual, social and occupational functioning as measured with frequently used assessment instruments such as the SF-36 or the IWQOL-Lite[38]. There are several potential mechanisms linking obesity to poor quality of life. The risks and symptoms associated with co-morbidities such as diabetes, osteoarthritis and hypertension, partly explains such an association[52]. When controlled for co-morbidity, obesity still has an independent impact on quality of life, as a consequence of physical limitations and of the stigma of being obese that affects mental and social domains of quality of life[53, 54]. Body dissatisfaction and low self esteem are common in obesity[38, 55] and are considered to mediate the association between stigmatisation and weight status[56].

Apart from co-morbidities and stigmatisation, several other problems may influence quality of life[57]. Not all obese persons suffer from an equally hampered quality of life. Quality of life will also depend on individual characteristics of persons that are part of personality or are related to experiences in the past.

In this paragraph the stigma of being overweight and minor, not often ventilated ailments influencing quality of life will be described as well as moderating factors that influence the association between obesity and quality of life.

The stigma of being obese

Obese persons may daily experience the adverse consequences from the physical and psychological load of their overweight. Discrimination and stigmatisation are pervasive phenomena, even now that the prevalence of overweight and obesity is high and obesity is relatively common. Many perceive that obese persons cause their own overweight and that overweight can and should be controlled[58]. Negative stereotypes, such as obese people being lazy, unmotivated, incompetent, lacking of self-discipline, are common[59]. Discrimination in work, educational possibilities, and in family relationships is not unusual[60, 61]. There is no law against discrimination at work due to obesity, as there is a law that prohibits such discrimination based on gender, race, nationality or religion. The obese persons themselves also associate obesity with negative charcteristics[62], and even in professionals in health care and research settings, who are dealing with the obesity problem and obese patients daily, a prejudice against obesity is not uncommon[59, 63]. These stereotypes about obesity, when not addressed properly, will influence the quality of life of obese persons[59]. Gaining consciousness is therefore important, among others in the context of bariatric surgery.

Other co-morbidities less frequently mentioned

Apart from the well known co-morbidities of obesity that obviously influence aspects of quality of life such as cardiovascular disease, diabetes and osteoarthritis, some problems are less often diagnosed when a patient applies for gastric bypass surgery.

A problem of obese persons, which will obviously influence body satisfaction, self esteem and social quality of life, is the existence of excessive perspiration and the general inability to clean oneself properly[57].

A common, often under-diagnosed problem in morbid obesity is obstructive sleep apnoea[64, 65]. Sleep apnoea causes sleep deprivation, both for the patient and for the bed partner. A person with sleep apnoea will often not feel refreshed after awakening and is excessively fatigued during daytime, with consequences for mental and social life[65, 66]. Also hypertension may occur as a consequence of sleep apnoea[67]. Furthermore, sleep apnoea is related to sexual dysfunction and depression[68]. Whether the sleep apnoea causes depression or vice versa, is not exactly clear, but the treatment of sleep apnoea can also alleviate depressive symptoms[69].

Independent of obstructive sleep apnoea, sexual problems can arise as a result of obesity. Sexual life in most patients with obesity is associated with lack of enjoyment of sexual activity,

lack of sexual desire, difficulties with sexual performance, and avoidance of sexual encounters[1]. Especially women suffer in this respect[1, 70]. Also, as a result of hormonal changes, both in men and women, sexual dysfunction is relatively common in obesity[71]. Sexual and hormonal disturbances decrease fertility both in men and women: in women because of increased androgen function causing anovulation[72], in men amongst others as a consequence of lower testosterone levels[73].
Obesity is, next to pregnancy and childbirth, an important factor causing strain on the pelvic floor in women, which may result in pelvic organ prolapse and stress incontinence[74, 75]. Stress incontinence can cause social and hygienic problems. Weight loss can improve the level of pelvic floor insufficiency and these associated clinical problems[76]. Finally, uterine prolapse can, apart from the direct consequences of obesity, aggravate sexual dysfunction[77].

Moderating factors

Most of the quality of life studies in obesity have a cross sectional design. A limitation of this design is the difficulty of disentangling possible causal relationships and crucial intervening variables –mediators- that explain the association between a determinant and an outcome variable. For instance, a behaviour such as lack of exercise can be one of the causal factors of obesity that subsequently causes a reduced quality of life, but it can also be a common cause of both obesity and a low perceived quality of life. Also, quality of life seems to be unequally influenced by differences between obese people. Individually different variables that interact with other determinants to produce a specific effect are called moderator variables. Some of the factors known to moderate the relationship between obesity and quality of life will be discussed here.
Gender is a major moderator influencing the extent to which a person's quality of life is decreased by obesity[78]. In the general population, women report a more severely reduced quality of life in most domains than men[3, 79]. In women seeking bariatric surgery, especially self-esteem, sexual life, and physical functioning are more severely affected compared to men, which may explain –among other variables- why more women than men apply for bariatric surgery[38, 80]. This reduced quality of life in women may be partly explained by the fact that receiving weight stigma is more a problem for women than men in romantic relationships[70]. Men, more than women, judge women on their appearances and regard overweight women as less suitable partners[70, 81].
Race is also moderating the relationship between quality of life and obesity. In comparison to whites, black adults seem to experience less impact of obesity on quality of life[3, 79]. In adolescents, these observations are only partly confirmed[82, 83]. It seems that quality of life in both black and white

adolescents is related to weight related teasing, and that, whereas in whites this most often results from peers, in blacks there is more often teasing within the family[84].
The impact of obesity on quality of life in different age groups also tends to be dissimilar. As can be expected, physical function, sexual life, and work related quality of life tend to decrease with age in obese persons[85]. On the other hand, self-esteem and public distress related to their obesity tend to improve with age[86].

QUALITY OF LIFE OUTCOME AFTER SURGERY

Whether or not quality of life assessments are part of the outcome evaluation after bariatric surgery, an important goal of bariatric surgery is to improve health and quality of life by means of losing weight.

Gains from surgery

The large effects of gastric bypass surgery on weight loss are beyond discussion. Surgery also positively influences quality of life. The outcome for quality of life is more subtle and complex compared to the weight loss and depends on several concomitant factors.
Significant weight loss and improvement in weight-related co-morbidities, such as diabetes, hypertension, gastro-oesophageal reflux, and medication use, which appear within a few months after surgery, immediately improve the health status of the patient[87-89]. Self-perceived quality of life is also better: most patients report improved vitality, physical functioning, self-esteem, and satisfaction with their physical appearance[89, 90]. Many every day life activities change after surgery and weight loss: patients experience less difficulty when moving around and are better able to perform daily tasks such as cleaning the home, cleaning themselves, and doing the shopping. With respect to body satisfaction after surgery, the extent of weight loss is not the most important factor. Also in people who lose less weight after surgery, the body satisfaction is high and in some even better compared to those who have experienced very rapid weight loss after surgery, resulting in excess skin[91, 92]. Scale scores on quality of life instruments, which deviated significantly from norm values at baseline, reach norm values or are sometimes even higher than norm values years after surgery[87, 92]. Even in patients experiencing complications during or after surgery, in super-obese patients and in patients with less than 50 percent excess weight loss, the quality of life after the

operation is higher than it was before the operation[89, 92, 93]. A drawback of the measurement scales needs to be considered. Disease specific questionnaires relate weight to aspects of quality of life. This hampers the quality of the postoperative assessment. In the IWQOL-Lite, all questions start with "because of my weight…". Because some patients will have returned to normal weight after surgery, these questions are not entirely suitable even if some adverse consequences of the previous state of obesity, like low self esteem, would still exist.

Psychosocial determinants of success

In pre-surgical screening, few personality traits and psychosocial determinants have been found to influence the postsurgical weight outcome, but many psychological determinants do predict postsurgical mental and social well being, which are two essential domains of quality of life[94, 95]. Preoperative depressive mood has been shown to be a significant predictor of postoperative quality of life, even if weight loss is substantial[96]. Therefore, although pre-surgical psychosocial functioning is not predictive for subsequent weight loss, it is important to identify those patients needing extra pre- or postsurgical interventions, resulting in better long term quality of life[97].

A specific problem, often considered to be a risk factor for insufficient weight loss after surgery, is the pre-existence of Binge Eating Disorder (BED), the consumption of an objectively large amount of food within a brief period of time (less than two hours), with the patient experiencing a loss of control and significant emotional stress. This behaviour, which is not followed by vomiting, is present for at least six months, and at least two times a week[55]. In normal weight persons, BED is present in about two percent, whereas in obesity, it is present in 15 to 30 percent of the patients[55]. BED has been a major concern related to surgery failure and some research indicated poorer outcome with respect to weight loss and quality of life after surgery, when patients showed BED prior to surgery[98]. In contrast, binge eating in many patients is reported to improve or totally disappear after surgery[90, 93, 99, 100]. Some patients on the other hand, after an improvement in the first months, experience recurrence of BED and concomitant weight gain[101, 102]. It is therefore important to evaluate postoperative, rather than only pre-operative behaviour, for sustained weight loss success and for improvement of quality of life[103].

Sexual abuse is related both to depression and to obesity[104]. Mechanisms thought to relate abuse to obesity are manifold, e.g. by inducing actual physical changes, psychological consequences (e.g., low self-esteem, sense of powerlessness), or behavioural problems[104]. A history of sexual abuse has been related to adult obesity and the failure of conservative obesity treatment, as a

result of non-compliance and lack of self-efficacy[105]. In surgery, results are somewhat different. For weight loss success, patients with and without a history of abuse had the same results but the group with a history of childhood sexual abuse showed a higher level of depression[106]. As a consequence, sexual abuse is not considered to be a contra-indication for surgery, but these patients need additional psychological treatment for their mental health problems[106].

It can be concluded that pre- and postsurgical evaluation and treatment of psychosocial problems are of great importance for targeting patients at risk for poor psychological outcomes, in order to improve the long term success of surgery with respect to weight loss as well as with respect to quality of life.

LONG TERM QUALITY OF LIFE OUTCOMES AFTER SURGERY: SPECIAL ISSUES

Although the majority of patients benefit from bariatric surgery and experience enhanced quality of life, in most if not all domains, some problems can threat the outcome. Issues reported by patients most often, will be described briefly.

An important issue is surplus skin, situated most commonly on the abdomen, the upper arms, the inside of the thighs, and also on the back, the cheek and over the knees. As a result fungal infections, itching and hampered physical activity are experienced, which together may cause severe psychosocial problems[107]. Many of these problems can be approached with reconstructive surgery after weight loss, and most patients feel more self-confident and attractive after such a procedure[108]. With the increased application of bariatric surgery in morbid obesity, it would be advisable to address the problem of skin abundance, and the possibility of plastic surgical interventions, in the evaluation of patients.

Neither frequently mentioned by patients nor frequently described in literature, is the occurrence of diarrhoea and malodorous flatulence[109]. Also vomiting and “plugging”, a feeling that food is not going down in the gastro intestinal tract, is a phenomenon reported by gastric bypass patients after surgery[110]. These problems can reduce quality of life and are only partly if at all mirrored in most routine quality of life assessments. To assess these factors that threat quality of life the Gastrointestinal Quality of Life Index could be used.[111, 112] Because this instrument has been developed for chronic gastrointestinal disease in general, it is not specific for all the post surgery problems of bariatric patients.

Another physical consequence related to malnutrition post-surgery, is the development of bone loss and skeletal fragility because of weight loss and altered nutrient metabolism. Long term evaluation and treatment of bone deficiencies, especially in post-menopausal women with a substantially reduced weight, may be necessary to prevent an increase of fractures in this group[113].

Perhaps most relevant for the valuation of quality of life, are the possibilities of patients to deal with their new body after surgery. Patients perceive their post surgical life as a rebirth or transformation[114], which poses them for specific changes and adaptations. Examples of such changes are increased feelings of vulnerability, changes in the social environment, such as marital dynamics or friendships[115], and the need of new skills such as implementing non-dietary means of coping with emotions[114]. The extent to which patients are able to adjust to their new life, highly impacts on their perceived quality of life. These important topics are not covered by routine quality of life measurement scales that focus on adjustment outcomes instead of adjustment processes that improve the outcome.

CONCLUSION AND FUTURE CHALLENGES

Gastric bypass surgery is highly effective in attaining weight loss and improving quality of life. Patients experience an immense transformation in physical, mental, and social well-being and functioning. Bariatric weight loss surgery is a large undertaking for patients. Obesity is a chronic disease, just like diabetes, chronic obstructive pulmonary disease, or alcohol addiction. Even if much of the excess weight is lost as a result of surgery, the disease requires a lifelong commitment of both the people that were once obese and the people in their social environment, as well as of a (multidisciplinary) treatment team. Both pre- and post surgical support, and a support that is unbiased by stigmatisation, are mandatory in order to achieve a satisfying quality of life for patients[116, 117].

For the assessment of quality of life in bariatric patients, most disease specific instruments are not fully applicable after surgery when patients have lost large amounts of weight. However, also the use of generic quality of life instruments can be of limited value, because patients after surgery, even if they report a relatively good generic quality of life, can perceive specific problems not included in these instruments. There is a need for the development of quality of life instruments addressing these specific themes. Another possibility would be the evaluation of generic instruments like the Pictorial Representation of Illness and Self Measure. With such instruments both the short and the

long-term quality of life of the individual bariatric patient, or a group of patients in a research setting, can be evaluated.

Another issue that needs consideration is the large group of morbidly obese people, especially men, that does not apply for surgery. Both the health and the quality of life of this group may be less severely reduced than for the group that does apply for surgery. However, in the long term, reduction of overweight is also very important for this group. It is possible that the quality of life outcome studies after bariatric surgery will be become a little bit less spectacular when also this morbidly obese group with a relatively high quality of life will be operated.

Even after successful surgery, patients have a life-long chronic disease which, like any other chronic disease, requires sufficient health care support and permanent consideration and life style adjustment of the patient, in order to result in long term good quality of life. A multi-disciplinary, person centred approach, and the evaluation of such an approach, in different (e.g., gender and age specific) groups, is the most relevant future challenge.

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3

Chapter 3

The health related quality of life of obese persons seeking and not seeking surgical or non-surgical treatment: a meta-analysis

Van Nunen AM, Wouters EJ, Vingerhoets AJ, Hox JJ, Geenen R. The health related quality of life of persons seeking and not seeking surgical or non-surgical treatment: a meta-analysis. Obes Surg 2007;17:1357-66.

ABSTRACT

Background: A meta-analysis examined differences in health-related quality of life (HRQoL) between seekers of surgical and non-surgical treatment, and non-treatment seekers, over and above differences that are explained by weight, age, and gender.

Methods: Our literature search focused on the 'Impact of Weight on Quality of Life-Lite' (IWQOL-Lite) and the 'Short Form-36' (SF-36) questionnaires. Included were studies published between 1980 and April 2006 providing (pre-treatment) descriptive statistics of adult overweight or (morbid) obese persons. Excluded were elderly and ill patient groups.

Results: Fifty-four articles, with a total number of nearly 100,000 participants, met the inclusion criteria. Persons seeking surgical treatment demonstrated the most severely reduced HRQoL. IWQOL-Lite scores showed larger differences between populations than SF-36 scores. After adjustment for weight, the population differences on the IWQOL disappeared. In contrast, the differences on the SF-36 between the surgical treatment seeking population and the other populations were maintained after adjustment for weight.

Conclusion: The IWQOL-Lite questionnaire predominantly reflects weight-related HRQoL, whereas the SF-36 mostly reflects generic HRQoL that is determined by both weight and other factors. Our meta-analysis provides reference values that are useful when explicating or evaluating obesity-specific (IWQOL-Lite) or generic (SF-36) HRQoL, weight, and demographic characteristics of obese persons seeking or not seeking surgical or non-surgical treatment.

INTRODUCTION

An increasing number of people faces the burden of obesity, which is defined as a Body Mass Index (BMI) of ≥ 30 kg/m^2 [1,2]. This worldwide epidemic is a concern to health professionals, because obesity is closely linked to risk factors associated with impaired health, shortened life expectancy[3], and reduced health-related quality of life (HRQoL)[4]. Our meta-analysis focuses on the impact of obesity on health-related quality of life. HRQoL is of relevance as an outcome measure in obesity, when treatment options are evaluated in terms of risks and benefits with regard to the health, well-being, and general functioning of the patient.

HRQoL may differ among subgroups of obese persons, who seek surgical or non-surgical treatment, or who do not seek treatment for their overweight. Some studies demonstrated greater impairment of HRQoL in people seeking treatment, especially treatment of greater intensity[5-8].The quantification of HRQoL in obese people seeking and not seeking treatment will indicate whether over and above other possible factors such as weight, age, and gender, the HRQoL differs among persons who seek a specific kind of treatment for obesity. In addition, such a quantification will provide reference data that are useful when evaluating the baseline status of obese individuals who apply for weight reducing interventions.

The literature of the past 26 years was reviewed in order to examine differences in baseline HRQoL between seekers of surgical treatment, seekers of non-surgical treatment, and non-treatment seekers. We additionally investigated the role of weight, age, and gender in the associations between HRQoL and treatment status.

MATERIALS AND METHODS

Selection of Studies

This meta-analysis comprises empirical studies in the English, French, German, or Dutch scientific literature. Included were reports of studies with adult, but not elderly or ill, populations, who were overweight (BMI ≥ 25 kg/m^2), obese (BMI ≥ 30 kg/m^2), or morbidly obese (BMI ≥ 40 kg/m^2) and who were seeking or not-seeking treatment for their weight. Non-empirical studies (dissertations, reviews, and books) were excluded. To be included in the meta-analysis, pre-treatment descriptive statistics of the HRQoL (mean, SD) had to be available in the identified research reports or

obtainable from the authors. We limited our search to the frequently used 'Impact of Weight on Quality of Life-Lite' (IWQOL-Lite) and 'Short from-36' (SF-36) questionnaires. The search strategy for identification of relevant literature was carried out in three phases. Figure A1 (see Appendix) presents the flow diagram. Eligibility was independently determined by two authors (AMvN, EJW).

Phase 1

The first phase determined which generic and obesity-specific instruments had been used to assess HRQoL in obese populations. The PubMed and PsycINFO databases were systematically searched from 1980 until April 2006 with the following keywords: quality of life AND (overweight OR obesity). This yielded 1071 titles from PubMed and 170 titles from PsycINFO. After exclusion of studies with children, elderly, and disease groups as well as non-empirical studies, 432 titles resulted. The abstracts were evaluated to determine whether the article was about HRQoL as related to seeking or not-seeking treatment for overweight or obesity. The remaining 150 abstracts included a wide range of instruments. Only studies that applied the frequently used obesity-specific IWQOL-Lite questionnaire (18 articles) and the generic SF-36 questionnaire (47 articles) were selected; two articles used both instruments.

Phase 2

The second phase searched additional articles with IWQOL-Lite or SF-36 data for overweight or (morbid) obese persons. The databases Web of Science, PubMed, and PsycINFO were searched until April 2006 with the following search strategy: (Impact of Weight on Quality of Life-Lite OR IWQOL-Lite OR Medical Outcome Survey Short-Form OR Short-Form 36 OR SF-36 OR Rand-36) AND (overweight OR obesity). The search resulted in one additional article that used the IWQOL-Lite and another 14 studies applying the SF-36.

Phase 3

The 82 full text articles of the abstracts identified in phase 2 were scrutinised. The aim of this third phase was to identify articles with the needed descriptive statistics (mean, SD). The authors of 24 studies have sent missing statistics upon request. When more articles of the same author(s) were found, the data were checked for duplications. In case of overlapping data sets, we asked the authors which data were the most recent and complete. This last phase left 54 articles (8 IWQOL-Lite, 44 SF-36, 2 IWQOL-Lite and SF-36) for meta-analysis. All articles were published after 1996.

Instruments

Impact of Weight on Quality of Life-Lite (IWQOL-Lite)

The 31 items of the IWQOL-Lite assess the impact of weight on quality of life in five areas (physical function, self-esteem, sexual life, public distress, work) and additionally yield a total score[5]. The five response categories range from "never true" to "always true". The IWQOL-Lite has adequate psychometric properties: Cronbach's alphas range from .90 to .94 for the scales and is .96 for the total scale[9]. The test-retest stability coefficients range from .81 to .88 for the scales and is .94 for the total scale[10]. The validity of the instrument is supported by findings such as sensitivity to weight loss[11] and the results of confirmatory factor analysis[9]. The meta-analysis uses transformed scores ranging from 0 to 100, with 100 representing the best and 0 the worst quality of life. A change of 7-12 points (depending on baseline severity) on the IWQOL-Lite total transformed score represents a clinically meaningful change[12].

Medical Outcomes Study SF-36 Health Status Survey (SF-36)

The SF-36 is a 36-item generic questionnaire measuring subjective health status[13]. It comprises eight domains of functioning: (1) physical functioning, (2) role limitations due to physical problems, (3) bodily pain, (4) general health, (5) vitality, (6) social functioning, (7) role limitations due to emotional problems, and (8) mental health. Transformed scores range from 0 (poor health) to 100 (good health). The SF-36 has adequate psychometric characteristics, including good construct validity, high internal consistency, and high test-retest stability[13]. A population difference of ≥ 5 points on any scale is considered clinically significant[13].

Data extraction

Five populations were distinguished: (1) the general population, (2) general obese people, (3) non-treatment seeking obese people, (4) conservative treatment seeking obese patients, and (5) surgical treatment seeking obese patients. All populations consisted of several groups, with exception of the non-treatment population, which comprised a single group in both the IWQOL-Lite[7] and the SF-36[8] meta-analysis. Studies recruiting participants from a community sample were considered to belong to the 'general population'; some of these studies identified groups who were (morbid) obese[14-17]. Participants who were recruited form the general population specifically because of their obesity were considered to be part of the 'general obese population'. This 'general obese population' differs from the 'non-treatment seeking population' in the sense that non-treatment seeking persons are

known to intentionally chose not to be treated for their obesity. Identified groups in the selected articles were assigned to a population following the recruitment criteria of the original study. The following data were extracted from the selected studies: BMI, age, gender, type of population, and means and standard deviations of the HRQoL variables.

Statistical analysis

For each population the weighted means of BMI, age, the percentage of women, and HRQoL variables were computed. Inverse variance weights (the sample size divided by the variance) were used as weighing procedure. The METAF.SPS macro[18] compared the weighted means of the populations by meta-analytic analogue to analysis of variance. We specified the random effects model using the method-of-moments plug in estimate of the METAF.SPS macro for the between-study variance.

To examine the influence of person characteristics on HRQoL, weighted multiple regression using the METAREG.SPS macro (random effects model)[18] examined differences between populations before and after adjustment for BMI, age, and gender, respectively. For each analysis, the dichotomised population indicators, i.e., belonging or not belonging to the general obese, non-treatment seeking, conservative treatment seeking, or surgical treatment seeking population, were entered in regression analysis. The BMI, age, and the proportion of female participants were entered in separate analyses to examine its effects, respectively. To graphically display the magnitude of differences between populations, effect sizes (statistic *d*) were computed. These statistics express the deviation from the norm group in standard deviation units[19]. Effect size values between 0.2 and 0.5, between 0.5 and 0.8, and greater than 0.8 reflect small, moderate, and large deviations, respectively[19].

All statistical analyses were performed with SPSS version 11.0 (SPSS Inc. Chicago, Ill).

RESULTS

Impact of Weight on Quality of Life-Lite (IWQOL-Lite)

Comparison between groups

The literature search yielded 27 groups from 11 studies, including over 6000 individuals: five groups from the general population[14,20], one non-treatment seeking group[7], fourteen conservative treatment seeking groups[5,14,21-23], and seven surgical treatment seeking groups[5,7,24-26]. No studies of the general obese population were found.

Table A1 (see Appendix) shows frequencies and (weighted) means of groups. The general, non-treatment, conservative treatment and surgical treatment populations differed significantly from each other with respect to BMI ($p < .001$) and age ($p = .02$), but not gender ($p = .51$). The weighted mean BMI was highest in the surgical treatment population (51 kg/m^2), followed by the non-treatment seeking population (44 kg/m^2), the conservative treatment population (37 kg/m^2), and the general population (29 kg/m^2). The weighted mean age of the non-treatment population (49 yrs) was high as compared to the surgical treatment population (41 yrs), conservative treatment population (40 yrs) and the general population (37 yrs). All populations included considerably more women than men; the percentages of women varied between 68% for the general population and 83% for the surgical treatment population. The four populations differed significantly from each other on all IWQOL-Lite scales ($p < .001$).

Figure 1 shows the mean deviations from the norm in standard deviation units, effect size d[19]. The HRQoL of the general population reflected a moderate to small ($-0.8 < d < -0.3$) deviation from the norm. The non-treatment and the conservative treatment populations had an intermediate position between the general population and the surgical treatment seeking population. Mean deviations from the norm were large for the non-treatment seeking population ($-3.3 < d < -2.4$) as well as for the conservative treatment population ($-3.0 < d < -1.6$). The surgical treatment seeking population ($-5.5 < d < -2.8$) demonstrated very severely reduced HRQoL scores on all scales.

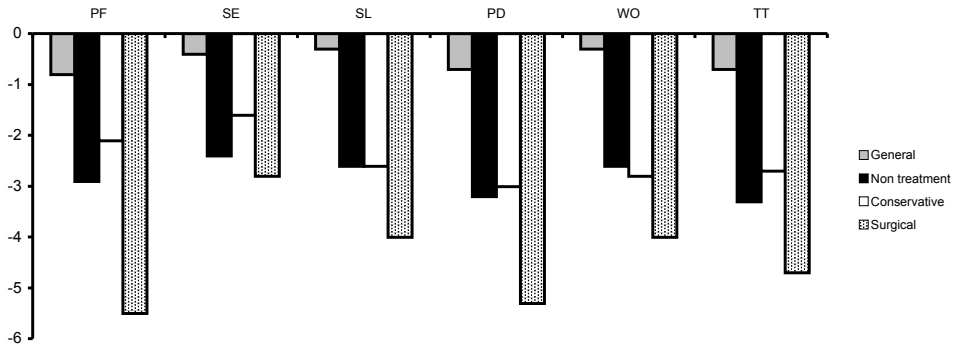

Figure 1. Mean deviation from the norm group in standard deviation units on the IWQOL-Lite for four populations.

PF: Physical function, SE: Self-esteem, SL: Sexual Life, PD: Public Distress, WO: Work, TT: Total

Adjustment for weight, age, and gender

Table 1 shows the unadjusted mean IWQOL-Lite scores of the populations as well as these scores after adjustment for BMI, age, and gender, respectively. The significance levels with the unadjusted means show that the non-treatment, conservative treatment, and surgical treatment populations have a significantly reduced HRQoL on all dimensions as compared to the other populations. The HRQoL differences between populations fully disappeared after adjustment for BMI. After this adjustment, the surgical treatment population even obtained the best score on public distress. This is probably due to (over)correction as a consequence of the very high correlation between BMI and public distress (r = -.90) in this meta-analysis. Adjustment for age and gender did hardly influence the HRQoL scores.

Table 1. IWQOL-Lite quality of life scores of four populations: unadjusted weighted means and estimated weighted means after adjustment for BMI, age, and gender

	PF	SE	SL	PD	WO	TT
Unadjusted weighted means						
General	77	81	91	88	92	83
Non-treatment	47 †	41 ‡	61 †	62 *	65 *	52 †
Conservative treatment	58 ‡	56 ‡	61 ‡	64 ‡	64 ‡	59 ‡
Surgical treatment	28 ‡	34 ‡	43 ‡	38 ‡	49 ‡	36 ‡
BMI §						
General	48	59	60	47	63	54
Non-treatment	59	49	73	78 *	79	64
Conservative treatment	52	52	56	56	58	54
Surgical treatment	59	55	74	80 *	81	66
Age ‖						
General	78	81	94	94	96	85
Non-treatment	45 †	40 ‡	53 ‡	49 †	53 †	46 †
Conservative treatment	58 ‡	56 ‡	60 ‡	61 ‡	61 ‡	58 ‡
Surgical treatment	28 ‡	34 ‡	43 ‡	38 ‡	49 ‡	35 ‡
Gender ¶						
General	78	81	92	90	91	84
Non-treatment	47 †	40 ‡	62 ‡	63 †	68 †	53 ‡
Conservative treatment	66 *	59 ‡	73 ‡	80 *	81 †	69 ‡
Surgical treatment	28 ‡	33 ‡	43 ‡	38 ‡	49 ‡	36 ‡

PF: Physical function, SE: Self-esteem, SL: Sexual life, PD: Public distress, WO: Work, TT: Total (the higher scores reflect a better quality of life)

* $p < .05$, † $p < .01$, ‡ $p < .001$, these p-values refer to the significance of the difference between the quality of life score of the specific population as compared to the quality of life of all other populations

§ Estimated weighted means after adjustment for BMI.

‖ Estimated weighted means after adjustment for age.

¶ Estimated weighted means after adjustment for gender.

Comparison between groups

For the SF-36, 88 groups from 46 studies were analysed, involving nearly 88,000 individuals: 35 groups from the general population[15-17,24,27-34], seven groups from the general obese population[35-38], one non-treatment seeking group,[8] 25 groups from the conservative treatment seeking population[8,30,35-52], and 20 groups from the surgical treatment seeking population[24,25,53-66].

Table A2 (Appendix) shows frequencies and (weighted) means of the groups. The populations differed from each other with respect to BMI ($p < .001$) and gender ($p = .05$), but not age ($p = .70$). Concerning BMI, non-treatment (33 kg/m^2), general obese (35 kg/m^2), and conservative treatment (36 kg/m^2) populations had an intermediate position between the morbidly obese surgical population (47 kg/m^2) and the general population (28 kg/m^2). The weighted mean age of the populations varied between 36 years for the non-treatment population and 44 years for the conservative treatment population. All populations included more women than men. The percentages of women varied between 54% for the general obese population and 86% for the surgical treatment population. The five populations differed significantly from each other on all SF-36 scales ($p < .001$).

Figure 2 shows the deviations from the norm[13] in standard deviation units. HRQoL of the general population was about equal to the norm group ($-0.1 < d < 0.1$). The non-treatment seeking population ($-0.3 < d < 0.0$), the general obese population ($-0.5 < d < -0.2$), and the conservative treatment population ($-0.4 < d < -0.2$) showed zero to moderate deviations from the norm. The surgical treatment population showed large to moderate deviations from the norm ($-1.6 < d < -0.5$).

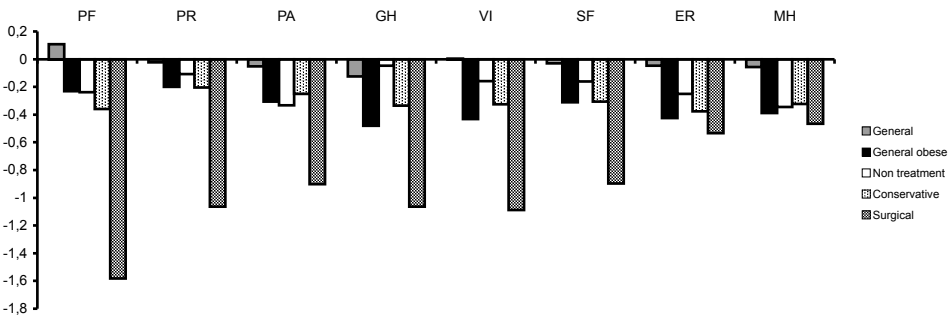

Figure 2. Mean deviation from the norm group in standard deviation units on the SF-36 for five populations.

PF: Physical functioning, PR: Physical Role - Role limitations due to physical problems, PA: Bodily pain, GH: General health, VI: Vitality, SF: Social functioning, ER: Emotional Role - Role limitations due to emotional problems, MH: Mental health

Adjustment for weight, age, and gender

Table 2 represents the unadjusted mean SF-36 scores of the populations as well as these scores after adjustment for BMI, age, and gender, respectively. The significance levels with the unadjusted means demonstrate that the conservative treatment and surgical treatment populations report a highly significant reduced HRQoL as compared to the other populations. With a few exceptions, after adjustment for BMI, differences between populations disappeared for the non-treatment, conservative treatment, and general obese populations. The exceptions concern the two mental health scales: role limitations due to emotional problems (ER) and Mental Health (MH), which remained low after weight was taken into account. After adjustment for BMI, the surgical treatment population as compared to the other populations still demonstrated a relatively low HRQoL on 5 of the 8 scales. Adjustment for age and gender did not affect the SF-36 HRQoL scores to a large extent.

Table 2. SF-36 quality of life scores of five populations: unadjusted weighted means and estimated weighted means after adjustment for BMI, age and gender

	PF	PR	PA	GH	VI	SF	ER	MH
Unadjusted weighted means								
General	87	80	74	69	61	83	80	74
General obese	79 †	74 *	68 *	62 *	52 ‡	76 †	67 ‡	68 †
Non-treatment	79	77	67	71	58	80	73	69
Conservative treatment	76 ‡	74 ‡	69 †	65 †	54 ‡	76 ‡	69 ‡	69 ‡
Surgical treatment	47 ‡	45 ‡	54 ‡	50 ‡	38 ‡	63 ‡	64 ‡	66 ‡
BMI §								
General	79	75	67	62	56	79	77	72
General obese	78	74	67	62	51	76	67 †	67 *
Non-treatment	76	76	65	69	56	78	72	68
Conservative treatment	77	75	70	66 *	55	77	70 †	69 *
Surgical treatment	62 ‡	54 ‡	67	62	47 †	70 ‡	68 *	70
Age ||								
General	86	80	74	70	61	83	81	75
General obese	80 †	76	69	63 †	52 ‡	76 †	66 ‡	67 ‡
Non-treatment	77	76	66	71	58	80	75	69
Conservative treatment	77 ‡	75 †	70 *	66 †	54 ‡	76 ‡	68 ‡	68 ‡
Surgical treatment	47 ‡	45 ‡	54 ‡	50 ‡	38 ‡	63 ‡	64 ‡	66 ‡
Gender ¶								
General	87	80	73	70	60	82	79	74
General obese	79 †	74 *	67 *	62 †	51 ‡	76 †	66 ‡	67 ‡
Non-treatment	79	78	68	71	58	81	74	69
Conservative treatment	76 ‡	74 ‡	70 *	66 †	55 ‡	77 ‡	70 ‡	69 ‡
Surgical treatment	48 ‡	46 ‡	55 ‡	50 ‡	39 ‡	64 ‡	66 ‡	67 ‡

PF: Physical functioning, PR: Physical Role - Role limitations due to physical problems, PA: Bodily pain, GH: General health, VI: Vitality, SF: Social functioning, ER: Emotional Role - Role limitations due to emotional problems, MH: Mental health (the higher scores reflect a better quality of life)
* $p < .05$, † $p < .01$, ‡ $p < .001$, these p-values refer to the significance of the difference between the quality of life score of the specific population as compared to the quality of life of all other populations
§ Estimated weighted means after adjustment for BMI.
|| Estimated weighted means after adjustment for age.
¶ Estimated weighted means after adjustment for gender.

DISCUSSION

This meta-analysis is the first that summarises and analyses HRQoL in diverse obese populations. Studies in well defined samples provided the data. The strengths of our study are the large sample sizes with the non-treatment seeking population as the only exception, the geographical diversity of the groups with North and South American, European, Asian, and Australian studies included, and the use of two well-established and validated HRQoL measures. These strengths contribute to the generalisability of the findings. In agreement with several studies[29,47,54,55,] it was shown that obese persons experience a poorer HRQoL compared to the general population. In particular, those seeking surgical treatment reported by far the most severely reduced HRQoL. The results obtained with the two instruments are discussed separately, because of the different results after correction for body weight.

IWQOL-Lite quality of life scores of obese populations deviated very much from scores of the norm group. However, these differences disappeared after adjustment for body weight suggesting that body weight is a main determinant of HRQoL as assessed with this instrument. Our observations suggest that IWQOL-Lite scores will improve after successful weight reduction, as has been reported in two studies[11,20]. These previous analyses and our findings indicate the usefulness of the IWQOL-Lite when one aims to explicate or evaluate weight-dependent HRQoL.

In contrast to the IWQOL-Lite, the SF-36 questionnaire suggested a less extreme deviation from the norm for obese populations. Not surprisingly[66], the surgical treatment seeking obese population demonstrated a large deviation from the norm on virtually all aspects of HRQoL. The reduction in HRQoL for the other obese populations tended to be zero to moderate. Covariance analysis suggested that HRQoL as assessed with this generic instrument is only partly dependent on differences in body weight. In the surgical population, the reduced quality of life on five of the eight dimensions was not solely explained by weight. Also the reduced scores on the two mental health scales in the general obese population and the conservative treatment population were not explained by weight alone. These findings therefore suggest that other factors than weight alone affect the quality of life of obese persons as measured by the SF-36. This result emphasises the validity of the SF-36 as a partly weight-independent outcome measure for general quality of life.

The current SF-36 findings suggest that obese persons experience limitations in their daily life and work due to emotional problems that are not fully explained by the magnitude of excess weight. An implication of this finding is that weight reduction alone will not suffice when attempting to positively affect mental health of these individuals. A subgroup of obese persons may need specific attention

for emotional problems.

In contrast to expectation[5-7], HRQoL as assessed by the IWQOL-Lite failed to differ between the populations after adjustment for weight. Also contrary to expectation, the general obese population and the conservative treatment seeking population had virtually similar SF-36 scores. Only in the surgical treatment population reduced physical and role functioning was observed that was not fully explained by weight. This may reflect the impact of co-morbid cardiovascular or joint problems that could be an additional reason to choose for or to be referred to surgical treatment. Overall our analyses suggest that only in the surgical treatment population, reduced physical functioning is a reason for seeking treatment over and above weight and weight-related quality of life.

Beside weight, age and gender were included as variables in the meta-analysis. Previous studies suggested that obese persons who seek treatment have a higher weight, are older, and are more often female than obese persons not seeking treatment[7,8]. Our results consistently confirmed that the weight of the surgical treatment population is higher than the weight of the other populations. No clear findings emerged with respect to age. Although epidemiological studies suggest that there is hardly a sex difference in obesity[1,67], all included populations, and most of all the surgical treatment seeking population, included more women than men. Thus, especially females who are on average between 40-50 years old are more inclined to participate in research and to seek treatment for their obesity.

A weakness of the present study is that the general obese population is likely to be a rather heterogeneous population including not only persons that do or do not intend to seek treatment for their obesity, but also individuals who choose their own diets or alternative treatments. Another weakness of meta-analytic techniques is that rather homogeneous group means of age and gender are used, whereas multiple regression analysis uses the full range of these variables. Therefore, the possibility that age and gender affect HRQoL is not definitively refuted by our findings. A further major weakness of our study and this specific field in general is that only two studies have investigated the intentionally non-treatment seeking population[7,8]. The small sample size in these studies hampers the generalisability of these findings. Future studies should focus on the non-treatment population, including the large group of non-treatment seeking men, with the aim to examine and analyse the factors which account for their reluctance to seek professional help to reduce weight and to improve health and HRQoL.

In conclusion, both the IWQOL-Lite and the SF-36 findings demonstrate a reduced HRQoL for the obese population, especially for the morbid obese population seeking surgical treatment. The IWQOL-Lite questionnaire predominantly reveals weight-related quality of life whereas the

SF-36 apparently assesses generic quality of life that is also determined by other factors than weight. Reductions in mental health could not be explained in terms of the magnitude of weight excess alone. This meta-analysis provides reference values that are useful when explicating or evaluating obesity-specific (IWQOL-Lite) and generic (SF-36) health related quality of life, weight, and demographic characteristics of obese persons seeking or not seeking surgical or non-surgical treatment.

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Chapter 3 appendix

The health related quality of life of obese persons seeking and not seeking surgical or non-surgical treatment: a meta-analysis

Van Nunen AM, Wouters EJ, Vingerhoets AJ, Hox JJ, Geenen, R. The health related quality of life of persons seeking and not seeking surgical or non-surgical treatment: a meta-analysis. Obes Surg 2007;17:1357-66 (suppl).

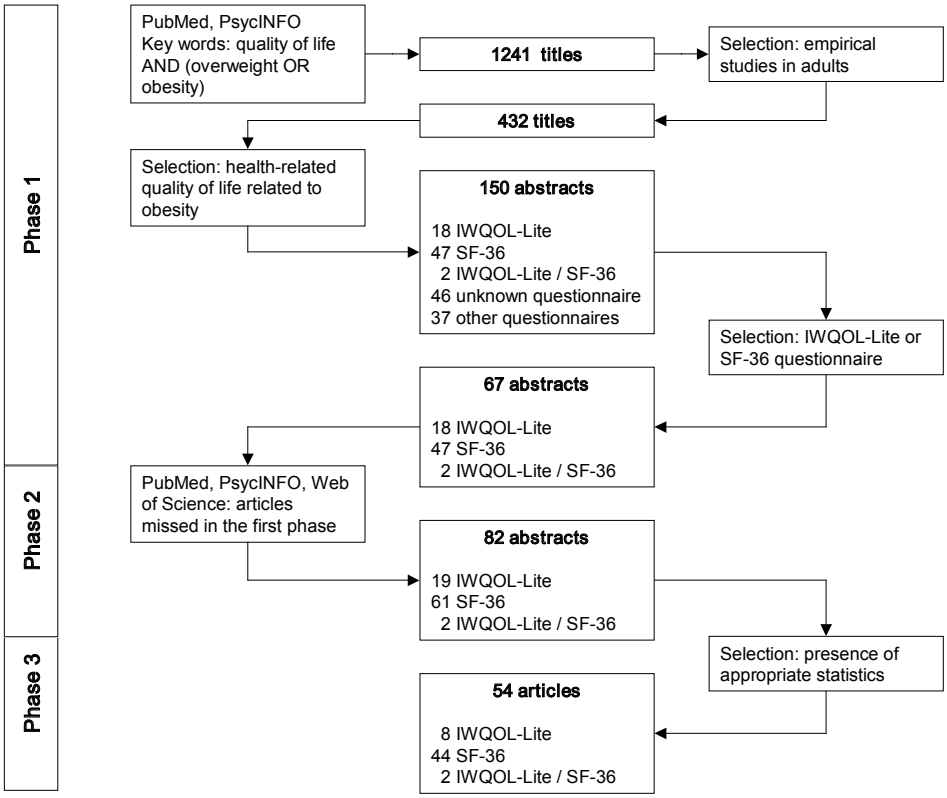

Figure A1. Flow diagram of the search strategy leading to the 54 articles included in the meta-analysis.

Table A1. Characteristics and weighted means on the IWQOL-Lite quality of life questionnaire for four populations before treatment

Author	N	Pw	BMI	Age	PF	SE	SL	PD	WO	TT
General population										
Boan[1] ‡	711	56	27	38	90	88	95	97	95	92
Engel-normal weight[2] *	146	100	22	36	91	92	98	99	99	94
Engel-overweight[2] *	78	100	27	36	80	78	94	95	94	86
Engel-obese[2] *	19	100	32	39	68	72	83	83	89	76
Engel-morbid obese[2] *	7	100	40	36	47	53	70	50	79	56
Weighted mean			29	37	77	81	91	88	92	83
Non-treatment population										
Kolotkin[3] *	87	71	44	49	47	41	61	62	65	52
Conservative treatment population										
Engel-overweight[2] *	69	100	28	38	82	70	89	96	95	84
Engel-obese[2] *	52	100	32	38	68	68	79	91	91	76
Engel-obese[2] *	17	100	38	40	56	55	71	67	86	63
Kolotkin-clinical trial[4]	1357	67	36	48	72	69	77	86	83	76
Kolotkin-outpatient program[4]	694	86	36	44	69	61	70	81	80	71
Kolotkin-day treatment[4]	736	60	39	49	57	57	66	72	72	63
Kolotkin-binge eating disorder[5]	95	76	42	45	50	39	59	59	61	52
Kolotkin-no binge eating dis.[5]	435	56	39	50	59	62	68	74	75	65
Lustig-placebo[6] *	40	0	39	39	35	46	26	19	15	31
Lustig-Sandostatin 20 mg[6] *	34	0	41	36	37	45	22	21	19	32
Lustig-Sandostatin 40 mg[6] *	53	0	41	40	44	51	35	29	29	40
Lustig-Sandostatin 60 mg[6] *	42	0	40	40	33	43	27	21	19	31
Rieger-binge eating dis.[7] †	56	89	37	42	68	47	69	74	77	64
Rieger-no binge eating dis.[7] †	62	81	37	37	77	62	77	83	84	76
Weighted mean			37	40	58	56	61	64	64	59
Surgical treatment population										
De Zwaan-binge eating dis.[8]	19	100	48	41	27	30	39	42	49	34
De Zwaan-no binge eat. dis.[8]	91	85	49	39	36	45	55	49	68	47
Dymek[9] †	80	80	53	39	24	31	46	32	51	33
Kolotkin[3] *	339	86	48	43	26	22	40	36	44	31
Kolotkin[4]	141	83	49	39	45	46	45	41	40	44
White[10] *	512	82	53	-	21	34	42	34	50	32
Weighted mean			51	41	28	34	43	38	49	36

N: sample size, Pw: percentage of women
PF: Physical Function, SE: Self-Esteem, SL: Sexual Life, PD: Public Distress, WO: Work, TT: Total (the higher scores reflect a better quality of life)
* This author supplied additional (not published) data
† The raw scores in the article were transformed to scores with a range from 0 to 100. ‡ Norm group

Table A2. Characteristics and weighted means on the SF-36 quality of life questionnaire for five populations before treatment

Author	N	Pw	BMI	Age	PF	PR	PA	GH	VI	SF	ER	MH
General population												
Brown-under/health weight[11] *	6931	100	22	47	88	83	74	75	61	83	79	74
Brown-overweight[11] *	3769	100	27	47	85	80	70	72	58	83	77	73
Brown-obese[11] *	2126	100	33	47	79	75	65	66	54	80	76	71
Brown-morbid obese[11] *	259	100	43	47	71	69	59	56	48	75	71	68
Brown-under/health weight[12] *	9826	100	21	20	92	84	75	70	58	77	71	68
Brown-overweight[12] *	1910	100	27	20	89	82	73	65	55	76	70	68
Brown-obese[12] *	685	100	33	21	86	81	72	62	54	76	69	67
Brown-morbid obese[12] *	76	100	43	21	79	77	69	56	50	71	71	62
Burns-men[13]	2042	0	25	43	90	84	83	71	68	87	85	76
Burns-women[13]	2352	100	25	42	87	80	79	70	63	83	80	72
De Zwaan[8] ‡	2474	0	-	-	84	81	75	72	61	83	81	75
Doll[14] * †	8561	56	-	-	88	87	79	71	58	83	86	72
Huang-normal weight[15] *	9420	49	22	40	93	85	83	71	68	87	81	73
Huang-overweight[15] *	3193	63	27	46	91	83	82	70	69	88	81	75
Huang-obese[15] *	566	56	32	42	88	81	80	67	68	85	79	75
Kaukua-chronic cond.[16]	1008	0	-	-	79	64	68	58	58	77	69	70
Kaukua-no chronic cond.[16]	897	0	-	-	92	87	86	73	70	88	82	78
Larsson-young/men/normal weight[17] *	735	0	22	25	98	91	85	84	70	91	89	81
Larsson-young/men/overweight[17] *	284	0	27	27	96	90	83	80	68	92	88	81
Larsson-young/men/obese[17] *	58	0	32	27	94	83	78	74	61	84	83	79
Larsson-old/men/normal weight[17] *	733	0	23	48	92	86	77	77	70	90	91	82
Larsson-old/men/overweight[17] *	804	0	27	49	89	82	74	74	68	89	88	81
Larsson-old/men/obese[17] *	148	0	32	50	87	89	79	73	70	89	89	82
Larsson-young/women/normal weight[17] *	778	100	22	25	96	86	81	81	63	86	82	77
Larsson-young/women/overweight[17] *	166	100	27	27	92	84	78	67	62	88	85	76
Larsson-young/women/obese[17] *	69	100	33	27	91	79	73	73	61	84	83	77
Larsson-old/women/normal weight[17] *	1101	100	22	47	89	82	74	76	67	87	88	80
Larsson-old/women/overweight[17] *	544	100	27	51	84	77	69	71	62	85	86	80
Larsson-old/women/obese[17] *	145	100	33	52	79	71	60	60	55	79	82	73
Le Pen-non obese[18]	562	0	-	-	84	80	70	66	58	79	82	67
Le Pen-obese[18]	236	0	-	-	80	82	69	66	58	80	81	67
Le Pen-obese[18]	155	0	-	-	75	73	65	62	53	77	76	68

Skalská-normal weight[19] *	204	50	22	23	97	79	80	75	60	79	67	71
Skalská-overweight[19] *	27	15	26	23	95	77	69	70	56	76	54	68
Surtees[20] *	12833	58	26	55	83	80	75	71	61	87	84	76
Yancy[21]	1182	0	-	55	55	48	48	53	49	69	69	71
Weighted mean			28	38	87	80	74	69	61	83	80	74
General obese population												
Dalle Grave[22]	50	90	34	36	83	77	67	64	48	54	27	51
Kaukua[23]	19	0	39	47	77	61	76	58	56	81	70	68
Patrick-European com.[24] *	3007	61	34	48	78	78	65	62	55	79	80	67
Patrick-US com.[24] *	1478	40	33	51	76	77	66	61	56	84	84	75
Patrick-initial validation[24] *	340	60	36	45	72	68	62	61	46	74	66	68
Rippe[25]	14	-	-	36	89	76	84	71	53	82	79	76
Weighted mean			35	44	79	74	68	62	52	76	67	68
Non-treatment population												
Fontaine[26]	89	82	33	36	79	77	67	71	58	80	73	69
Conservative treatment population												
Chaput[27] *	11	0	33	38	93	90	90	73	63	91	87	82
Dalle Grave-GSH[22]	58	88	34	37	80	75	65	67	44	52	29	49
Dalle Grave-M-GSH[22]	53	91	34	36	84	77	67	71	48	56	31	56
Fontaine[28]	38	66	31	37	86	82	67	72	53	87	82	76
Fontaine[26]	312	74	38	39	72	70	53	63	45	77	73	68
Goulis-waitlist controls[29]	77	90	38	45	63	54	56	61	51	62	59	55
Goulis-intervention group[29]	45	87	38	44	61	73	62	60	57	72	60	64
Hayward[30]	8	100	38	45	61	63	60	63	52	60	67	68
Kaukua[23]	19	0	39	46	71	74	71	61	66	83	78	78
Kaukua[16]	126	66	43	48	57	59	62	49	54	76	68	70
Laferrere-white[31] *	62	100	35	49	77	72	72	73	52	81	70	72
Laferrere-black [31]*	80	100	36	44	74	75	67	71	55	77	73	74
Lee[32]	212	70	30	37	85	73	76	56	60	79	72	66
Marchesini[33] *	183	80	36	44	71	64	62	57	52	66	60	60
Marchesini-CBT group[34]	92	84	37	43	68	60	60	55	51	63	59	58
Marchesini-waitlist controls[34]	76	88	35	43	71	64	61	57	51	64	57	59
Marchesini[35] *	207	82	36	43	74	72	66	60	55	69	65	62
Masheb[36] *	94	78	35	45	75	67	61	65	40	67	53	59
Ni Mhurchu[37]* †	250	82	35	48	78	76	70	68	54	83	77	76
Patrick[24] *	1282	82	37	45	76	85	74	71	61	87	86	74

Rippe[25] *	-	-	-	37	83	83	80	78	52	82	75	75
Samsa-placebo[38]	205	53	35	50	81	85	81	73	62	91	87	81
Samsa-Sibutramine[38]	271	55	35	50	81	87	81	73	62	90	86	80
Teixeira[39] *	111	100	31	48	88	77	83	77	59	92	73	80
Wamsteker[40]	66	73	39	46	68	75	73	64	62	83	80	76
Weighted mean			36	44	76	74	69	65	54	76	69	69
Surgical treatment population												
Ahroni[41]	195	83	46	44	67	48	49	46	34	67	77	67
Choban[42] *	53	85	51	40	44	53	54	59	37	67	75	69
De Zwaan-binge eating dis.[8]	19	100	48	41	37	24	39	39	19	51	54	68
De Zwaan-no binge eating dis.[8]	91	85	49	39	43	45	47	42	32	62	80	71
Dixon[43]	459	85	45	-	46	41	63	43	33	54	52	59
Dymek[44]	32	81	57	39	39	36	44	43	28	64	74	72
Dymek[9]	80	80	-	39	38	32	41	35	29	49	53	58
Fabricatore[45]	306	81	53	44	41	49	52	-	-	-	-	-
Hörchner[46]	42	100	41	-	83	71	81	77	64	83	83	75
Hörchner[47]	39	100	41	-	73	71	82	77	64	84	85	77
Larsen[48] *	93	83	47	39	40	53	52	48	43	60	68	62
Malone[49]	109	83	48	45	52	49	53	55	44	69	68	69
Nguyen[50]lap. GBP	79	91	48	40	47	47	51	55	39	64	49	73
Nguyen[50]open GBP	76	88	48	42	40	38	49	53	37	62	46	72
Nickel[51]gastric banding gr.	22	100	47	38	38	33	36	42	31	56	56	48
Nickel[51]non surg. group	35	100	45	40	38	34	36	42	31	56	56	48
O'Brien[52] *perigastric	101	86	45	40	47	49	62	42	35	53	53	58
O'Brien[52] *pars flaccida	101	91	45	40	45	44	63	43	31	57	54	58
Ohrström[53]	11	100	41	44	46	32	39	52	41	59	33	69
Van Hout[54] *	88	86	46	38	50	61	66	52	58	72	75	73
Weighted mean			47	40	47	45	54	50	38	63	64	66

N: sample size, Pw: percentage of women
PF: Physical Functioning, PR: Physical Role - Role limitations due to physical problems, PA: bodily Pain, GH: General Health, VI: Vitality, SF: Social Functioning, ER: Emotional Role - Role limitations due to emotional problems, MH: Mental Health (the higher scores reflect a better quality of life)
* This author supplied additional (not published) data
† These are the aggregated means of subgroup data in the article
‡ Norm group

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Chapter 4

Suffering quantified? Feasibility and psychometric characteristics of two revised versions of the Pictorial Representation of Illness and Self Measure (PRISM)

Wouters EJ, Reimus JL, van Nunen AM, Blokhorst MG, Vingerhoets AJ. Suffering quantified? Feasibility and psychometric characteristics of two revised versions of the Pictorial Representation of Illness and Self Measure (PRISM). Behav Med 2008;34:65-76.

ABSTRACT

Objective: The Pictorial Representation of Illness and Self Measure (PRISM) is hypothesised to measure suffering. We explored the feasibility and psychometric qualities of two revised versions of the PRISM: PRISM-R1 and PRISM-R2.

Methods: This report covers three studies. Participants of Study I were patients with lung disease, psoriasis, female fertility problems, (former) breast cancer, and whiplash. Study II comprised whiplash patients before and after a multidisciplinary intervention, while in Study III morbidly obese patients were included. The original PRISM task yields a single quantitative measure, the Self-Illness Separation (SIS) which has been suggested to measure suffering. The revised PRISM versions yield an additional variable, the Illness Perception Measure (IPM), hypothesised to measure subjective illness severity. To assess the validity of the PRISM-R, in all three studies the Health Monitor Questionnaire was used as the reference standard. In addition, in Study III the Perceived Disease Impact Scale (PDIS) and the Symptom Checklist (SCL-90) were used.

Results: In Study I, significant differences between patient groups were found, suggesting most suffering in the whiplash and infertility patients. Study II revealed that both SIS and IPM changed significantly in the predicted direction after the intervention, indicating that PRISM-R is sensitive to change. In Study III, a significant negative correlation was found between IPM and health status, life satisfaction, psychological well-being (HMQ), perceived disease impact (PDIS) and a significant positive correlation between IPM and psychoneuroticism (SCL-90). SIS and IPM were only weakly negatively associated and showed different correlation patterns with the self-report measures of well-being and health (HMQ, PDIS, SCL-90), indicating that they measure different aspects of the patients' illness experiences.

Conclusion: This study has yielded preliminary support for the feasibility and validity of the variables assessed by PRISM-R (SIS and IPM), in measuring aspects of suffering. However, the relationship between the current findings and results obtained with the original PRISM task remains unclear and more research is needed on the associations of suffering and illness severity with disease variables, personality factors and coping aspects.

INTRODUCTION

Disease is generally considered to be associated with a certain degree of suffering. Although a major objective of medicine is to alleviate suffering[1,2], this is not always the outcome of medical treatment. A decrease in physical symptoms might even be accompanied by an increase in suffering (e.g., during chemotherapy in cancer patients). However, suffering is also regarded as a rather vague construct and until now instruments which claim to quantify suffering were hardly available[3,4]. Büchi and Sensky[5] were the first to introduce a generic assessment method, the Pictorial Representation of Illness and Self Measure (PRISM), hypothesised to measure the burden of suffering due to illness. The original PRISM consists of a rectangular (A4 size) metal board, with a fixed yellow circle (7 cm in diameter) in the bottom right-hand corner (see figure 1).

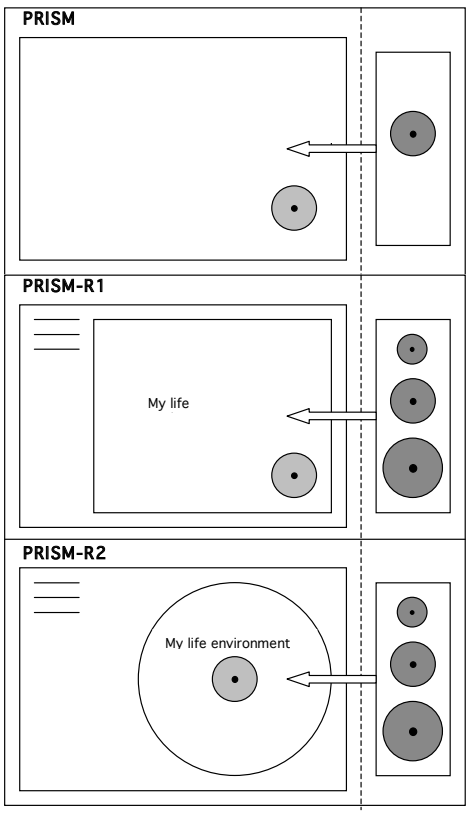

Figure 1. The three versions of the Pictorial Representation of Illness and Self Measure: PRISM, PRISM-R1 and PRISM-R2.

Patients are asked to imagine that the white board represents their current life and the yellow circle their 'self' (self-disk). They subsequently receive a magnetic red disk (5 cm in diameter), which represents their illness (illness-disk), and are asked to place the illness-disk on the board to represent the place of the illness in their current life. The patient receives oral standard instructions explaining the task. The quantitative measure derived from this application, the distance between the centres of both disks, is referred to as Self Illness Separation (SIS). It is assumed that patients have cognitive representations of their 'self' and their illness and that healthy adjustment to the disease implies that there is a separation between 'self' and the illness schema[6]. Qualitative research has demonstrated that this instrument was probably measuring something more complex than just coping which was originally proposed by the authors. Comments of patients completing the PRISM task revealed that the SIS measure is associated predominantly with patients' perception of the intrusiveness of the illness, its controllability, and the interference of the illness with salient aspects of everyday life[5]. In essence, PRISM is a visual representation of the relationship between the person's 'self' and his/her illness. The original PRISM task has been used for over 10 years[5]. The task has no precedents, and this means that there were no data available to guide precisely how the task should be administered and applied.

As pointed out by Büchi et al.[7] the above mentioned themes are closely linked with Cassell's notion of suffering[1]. This author defines suffering as "the state of severe distress associated with events that threaten the intactness of the person". The extent of suffering associated with disease is not only determined by the objective disease characteristics, but also by the meaning an individual attributes to the threat to his or her 'personhood'. This implies that a number of individual characteristics, including personality, past life experiences, social support, cultural background, and self-esteem are supposed to moderate the extent of suffering. For example, patients are more likely to report suffering when the disease is perceived as out of control or overwhelming, if the source of the disease is unknown or if patients cannot attach meaning to their disease, and if the disease is apparently endless.

To date, PRISM data have been collected in a fair number of patient groups[5,7-9] and have yielded preliminary support for the validity and reliability of this instrument. In a validation study[7] involving over 700 patients with different physical disorders (rheumatoid arthritis, chronic obstructive pulmonary disease, systemic lupus erythematosus, osteoarthritis, and diabetes mellitus), SIS was significantly associated with a number of measures of physical and psychological functioning, but showed no significant correlations with specific disease variables. In a recent study measuring suffering in psoriasis patients, the same lack of association was found between PRISM measures

and objective illness severity[10]. Correlations with depressive symptoms, coping, and Medical Outcomes Study 36-item short form health survey (SF-36) subscales[11] varied among different patient groups. This pattern of findings is consistent with the idea of PRISM as a measure of suffering, because the contribution of particular physical and psychological variables to suffering is expected to vary from one illness to another. In addition, SIS shows good inter-rater and test-retest reliability and is sensitive to change. In summary, preliminary validation data have demonstrated that PRISM behaves to a large extent as may be expected of a measure of suffering. However, in absence of any known validated instrument for suffering, establishing construct validity remains a difficult issue[5,7].

Recently, we developed two modifications of the original PRISM task, the PRISM-R1 and PRISM-R2 (figure 1), because patients commented that the 'size' of their disease could be perceived very differently. In addition, we noticed that patients occasionally considered the middle of the A4 sheet as the central point in their life, rather than the self-disk. The major change of the first modification (PRISM-R1) therefore involved giving patients a choice of three different sized illness-disks. The second modification (PRISM-R2) involved placing the self-disk in the middle of a large printed circle, rather than in one corner of a rectangular sheet as in the original PRISM.

In three separate studies, the feasibility and psychometric qualities of the two revised versions of the PRISM were explored. Two studies were carried out with PRISM-R1. In the first one, the potential use of the PRISM-R1 as a generic measure for suffering by comparing results of five different patient groups was explored, and its validity was examined. In the second study the sensitivity to change of the PRISM-R1 was tested by comparing pre- and post treatment data of a group of whiplash patients participating in a multidisciplinary intervention programme. PRISM-R2 was evaluated in a third study involving the collection of additional qualitative and quantitative data among morbidly obese patients seeking bariatric surgery. This latter study was designed to investigate the content validity and the convergent and divergent construct validity of the SIS and IPM. In summary, we hypothesised that the PRISM-R1 and PRISM-R2 measure suffering, and that beyond SIS, IPM adds to a further quantification of suffering. If so, PRISM-R1 and especially PRISM-R2 could be useful and feasible instruments in the research and evaluation of the suffering of patients.

STUDY I

Methods

Patient samples

Participants were patients with the following medical problems: (1) lung disease (N = 32); (2) psoriasis (N = 59); (3) female fertility problems (N = 42); (4) (former) breast cancer (N = 59), and (5) whiplash (N = 29) (see table 1). Participants were approached by their physicians. Measures were completed in the hospital or at home. All participants provided written informed consent.

Table 1. **Overview of patient samples participating in the three studies**

Study	Patient samples	n	Sex (m/f)	Age Mean	Range	SD	Validation criteria
1	Psoriasis	59	33/25*	48.6	14-83	15.4	
	Fertility problems	41	-	31.8	27-42	3.2	
	Lung disease	30	15/15	57.3	30-77	11.9	Convergent validity
	Breast cancer	59	-	61.9	36-83	11.1	
	Whiplash	29	7/22	33.7	18-58	10.3	
2	Whiplash intervention group	21	14/7	36.5	20-56	11.2	Sensitivity to change
3	Morbid obesity	55	13/42	37.6	22-59	8.7	Content validity Convergent and divergent validity

Measures

The Pictorial Representation of Illness and Self Measure - Revised (PRISM-R1)

The PRISM-R1 consists of a white A4-size paper sheet (in which a slightly smaller rectangle is drawn, representing the patient's life-environment), with a printed yellow disk 52 mm in diameter in the bottom right-hand corner, representing patient's 'self', the so-called self-disk (figure 1). The text 'self' is printed on the yellow disk. Whereas in the original PRISM the illness-disk has a fixed diameter, slightly smaller than the self-disk, the PRISM-R1 gives respondents the choice of three differently sized red disks (stickers), representing the patient's medical problem, the so-called illness-disks. These illness-disks are, respectively, smaller, equal and larger (35 mm, 52 and 65 mm in diameter) than the self-disk. The stickers contain the text 'my medical problem'. Patients

were asked to choose whichever of these three illness-disks in their view best represented their illness. After having chosen the most appropriate disk, the patients were asked to attach the illness-disk to the paper sheet, in such a way that it best represented the patient's current view of the position of his/her medical problem in the his/her current life. In the original studies[5,7] patients completed the PRISM in the presence of a clinician. In the current study PRISM-R1 has been used as a self-completion task, sent to patients by mail or handed out by a nurse or clinician.

The following two variables were derived from the PRISM-R1: (1) self illness separation (SIS), ranging from 0 to 202 mm; a greater distance between the self and the illness-disk is hypothesised to represent less suffering, and (2) Illness Perception Measure (IPM), ranging from 1-3 with a higher size of the illness-disk indicating a greater perceived severity of the illness.

Health Monitor Questionnaire (HMQ)

The HMQ[12,13] assesses subjective aspects of health and well-being. It consists of three scales: (1) subjective health status (8 items), (2) life satisfaction (5 items), and (3) psychological well-being (5 items), each scored on a five-point scale. Higher values indicate better well-being. Items used in this questionnaire were derived from existing questionnaires like the General Health Questionnaire[14], the Center for Epidemiologic Studies Depression - scale (CES-D)[15] and the World Health Organisation Quality of Life- scale (WHOQOL-100)[16]. Correlations between the HMQ scales and the Depression and Anxiety subscales of the Hospital Anxiety and Depression Scale[17] and the WHO-5 Well-being Index[18] are moderate to fairly high. The HMQ has been administered repeatedly to a representative sample of the Dutch population. Coefficients alpha for the HMQ scales vary between .75 and .90[13].

Statistical analyses

One-way analyses of variance were used to make comparisons between patient groups for the PRISM-R1 variables. The Tukey post-hoc test was applied in case of equal variances and the Tamhane post-hoc test in case of unequal variances (SIS and subjective health status). To assess the convergent and divergent validity, Pearson product-moment correlations were calculated between PRISM-R1 variables and HMQ scales. All statistical analyses were performed using SPSS-14.

Results

Comparison between patient groups

Analyses of variance revealed significant differences between the patient groups on both SIS ($F_{(4, 207)} = 11.39$; $p < .001$) and IPM ($F_{(4, 207)} = 6.63$; $p < .001$). Significantly smaller mean SIS values were found in women with fertility problems compared to all other groups ($p < .005$) except for whiplash patients. Whiplash patients also had smaller mean SIS values compared to patients with lung disease ($p < .001$) and breast cancer ($p < .005$). IPM was highest for whiplash patients and differed significantly from the other groups ($p < .05$) except for women with fertility problems. Women with fertility problems had higher IPM values in comparison with breast cancer patients ($p < .05$). Table 2 summarises the descriptive statistics of all patient groups.

Table 2. Means and standard deviations of Health Monitor Questionnaire scales and PRISM-R1 variables (study 1, study 2)

	Mean and standard deviations of									
	Health status		Life satisfaction		Psych. well-being		SIS		IPM	
	M	SD	M	SD	M	SD	M	SD	M	SD
Study 1										
Psoriasis	29.9	6.6	17.7	3.4	18.6	3.8	85.3	59.2	1.6	0.8
Fertility problems	31.7	5.1	20.0	3.3	18.5	3.0	46.0	37.5	1.8	0.7
Lung disease	29.0	6.2	19.2	3.4	20.2	3.2	121.5	60.9	1.5	0.6
Breast cancer	31.7	6.4	19.0	3.5	19.1	3.3	104.8	70.8	1.4	0.6
Whiplash	20.7	3.8	16.2	3.6	16.4	3.3	56.9	45.2	2.1	0.7
Study 2										
Whiplash										
Pre intervention	20.6	4.0	14.5	2.9	15.0	2.1	35.1	22.5	2.2	0.6
Post intervention	23.5	4.6	14.8	2.8	16.6	3.1	46.1	32.9	1.9	0.6

Validity findings

There were no significant associations between SIS and the HMQ scales, except for health status (negative correlation) and life satisfaction (positive correlation) in women with fertility problems (see table 3). In contrast, IPM correlated negatively with health status in all patient groups. Life satisfaction was associated negatively with IPM in psoriasis and breast cancer patients. Psychological well-

being was linked negatively with IPM in whiplash, psoriasis, and breast cancer patients.

Correlations between SIS and IPM were weakly negative in all patient groups, with just one significant, negative correlation for the breast cancer group (r = - .41; p < .01).

Table 3. Correlations between SIS, IPM and Health Monitor Questionnaire scales for the different patient groups (study 1)

		Whiplash	Lung disease	Psoriasis	Fertility problems	Breast cancer
SIS	Health status	0.24	0.06	0.02	- 0.31*	0.19
	Life satisfaction	0.25	0.05	- 0.18	0.33*	- 0.02
	Psychological well-being	0.24	0.18	0.03	- 0.12	0.15
IPM	Health status	- 0.48**	- 0.48**	- 0.51**	- 0.42**	- 0.48**
	Life satisfaction	- 0.28	- 0.13	- 0.33*	- 0.05	- 0.28*
	Psychological well-being	- 0.52*	- 0.15	- 0.54**	- 0.26	- 0.52*

* p < .05, ** p < .01

STUDY II

Methods

Patient sample

Twenty-one patients participating in a multidisciplinary whiplash intervention programme provided data, before and after the programme (see Table 1). The programme consisted of 16 sessions, twice weekly for eight weeks. It focused on teaching whiplash patients the basic coping principles for adequately dealing with pain and stress. Key elements characterising the intervention included its multidisciplinary character, with emphasis on cognitive therapy, graded exposure, and stress management. All participants provided written informed consent.

Measures

PRISM-R1 and HMQ, the same measures as in Study I, were applied.

Statistical analysis

Sensitivity to change was evaluated by comparing pre- and post-treatment values, using paired *t*-tests (SPSS-14).

Results

Sensitivity to change (PRISM-R1)

Table 2 summarises the descriptive statistics (M, SD) of the PRISM-R1 variables and the HMQ scales for the whiplash patients before and after the intervention.

Post-treatment SIS was significantly higher than pre-treatment SIS ($t_{(20)}$ = -2.32; $p < .05$), whereas post-treatment IPM was significantly lower, compared to pre-treatment values ($t_{(20)}$ = 3.51; $p < .01$). After treatment, subjective health status ($t_{(20)}$ = -3.27; $p < .01$) and psychological well-being ($t_{(20)}$ = -2.57; $p < .05$) were significantly higher than before treatment. There was no significant difference in pre- and post-treatment life satisfaction.

STUDY III

Methods

Patient sample

A group of 55 morbidly obese patients (body mass index; M = 43.4 kg/m², SD = 6.4) seeking bariatric treatment participated in this study (see Table 1). Patients were approached by a psychologist during their presurgical visit at the medical psychology department of the hospital (N=18; 22.7 %) or by mail (N=37; 67.3 %).

This study was approved by the ethical committee of St. Anna Hospital, Geldrop, the Netherlands.

Measures

The Pictorial Representation of Illness and Self Measure - Revised 2 (PRISM-R2)

In order to make the center of one's life coincide with the self, the self-disk was situated in the middle of a large circle representing one's life. More precisely, the self-disk was printed in the middle of a large printed circle (186 mm in diameter) containing the text 'my life environment', with a SIS-range of 0-93 mm (Figure 1). The other features of the PRISM-R1, in particular the three differently sized illness-disks, remained unchanged.

Health Monitor Questionnaire (HMQ)

The HMQ, as described in Study I, was applied to evaluate subjective health status, life satisfaction, and psychological well-being.

Perceived Disease Impact Scale (PDIS)

The PDIS has been newly developed to measure the influence of the illness on various life domains, including well-being, lifestyle, activities, relationships, work, personality, interests and trust in ones own body[19,20]. Its 20 items originate from several sources, such as the Illness Intrusiveness Rating Scale[21], a similar instrument to assess the impact of depression[22], and the literature on the effects of cancer[23] and multiple sclerosis[24] on the lives of patients. The response format consists of a 7-point Likert scale ranging from 'very negatively' (-3) to 'very positively' (+3). The internal consistency of the PDIS is very high (coefficient alpha .95 in the present morbidly obese patient group).

Symptom Checklist - 90 (SCL-90)

The SCL-90[25,26] has been designed to assess the psychological symptoms experienced in the past week. It allows for a global assessment of psychopathological distress. For each item, patients indicate how much that problem has distressed them during the last week. Items are rated on a five-point scale, ranging from 1 (not at all) to 5 (extremely). The SCL-90 consists of eight different domains (anxiety, agoraphobia, depression, somatic complaints, insufficiency in thinking and acting, sensitivity, hostility and sleeping problems) and a total score (psychoneuroticism). After transformation of the raw scores, each scale ranges from 1 to 7 (very low to very high). The SCL-90 has an acceptable reliability and validity. Coefficients alpha range from .57 to .95[25].

Analyses

The content validity of SIS and IPM was assessed by asking the morbidly obese patients, after having completed the PRISM-R2 task, to give written explanation why they had chosen the particular size of the medical problem sticker and why they had placed it at the specific spot of their choice. These comments were categorised and analysed. To assess the convergent and divergent validity, Pearson product-moment correlations were calculated between the PRISM-R2 variables (IPM and SIS) and HMQ scales, PDIS, and SCL-90, and also between SIS and IPM.

Results

Content validity (PRISM-R2)

Table 4

Table 4a. Examples of patient comments on their choice for positioning the 'self' disk (SIS)

SIS themes and statements		
Themes	*Low SIS statements* (SIS < 52 mm, overlap with 'self')	*High SIS statements* (SIS > 52 mm, no overlap with 'self')
1. Impact of the patient's medical problem on daily life	My obesity interferes with everything: movement, work, mood (SIS = 0 mm)	My obesity is something close to me. I carry it around all day. However, it doesn't control my life. (SIS = 64 mm)
2. Impact of the medical problem on health status	For me it is very important to lose weight because of my back and feet complaints (SIS = 0 mm)	My medical problem doesn't cause me psychological health problems, I am not ashamed of my appearance (SIS = 59 mm)
3. Attributed origin of the medical problem (self, other/ something else)	I am the problem myself (SIS = 2 mm) Overweight is a problem beyond my power (SIS = 29 mm) It is part of myself and part of others (harassments) (SIS = 47 mm)	
4. Judgment of the social environment of the patients' medical problem	Because it bothers me more than it bothers other people (SIS = 8 mm) Other people are more bothered about my overweight than I am (SIS = 29 mm)	Problems arise mainly in my environment, e.g. life insurance (SIS = 60 mm)

Table 4b. Examples of patient comments on their choice for the sticker size (IPM)

IPM themes and statements			
Themes	*Sticker size 3*	*Sticker size 2*	*Sticker size 1*
1. Severity of the medical problem	Because my medical problem is very big. The sticker can not be big enough.	Because my problem is not terribly big, but also not small.	I do not see my overweight as a problem.
2. Impact of the medical problem on daily life	My overweight dominates all levels of my life: social, psychological, business-like, physical. So for me it is a large problem. Because I do not dare to walk in the streets.	The problem does not bother me in everything.	I chose for the small sticker size because my medical problem doesn't interfere with my daily life.
3. Impact of the medical problem on health status	I chose for the large sticker because I have a lot of physical complaints caused by my overweight.	I chose this sticker size because it causes physical problems in my present life.	My medical problem is not a life threatening problem
4. Expected (future) health risks	Because my life expectancy will be much shortened if nothing is done.	Because of the risks it is a point of attention.	I don't have medical complaints at the moment, though I want to change because they may possibly arise in future.

Tables 4a and b present a few typical examples of patients' comments, both of low and high IPM scores and of low and high SIS scores (i.e., overlapping or not overlapping self and disease). The patients' comments regarding SIS could be clustered globally into the following four themes: (1) impact of the medical problem (obesity) on daily life; (2) impact of the medical problem on health status; (3) attributed origin of the medical problem (self, other/something else); and (4) judgment of the patients' medical problem by the social environment. Themes 1 and 2 were the most frequently reported themes. In general, low SIS respondents often provided comments stressing the strong interference with daily life and the negative impact of their obesity on their health status, while high SIS patients experienced little interference with daily life. Attribution was only a frequent theme in patients with low SIS (it was never mentioned in obese persons associated with high SIS). Patients attributed the origin of morbid obesity almost equally to themselves as to others/something else. Disapproval by the social environment of the patient's medical problem was found in both low and

high SIS individuals. In low SIS, some people experienced social disapproval, whereas others considered their own experiences far more important than social judgement. In high SIS, social disapproval was experienced in only one case (table 4a).

The patients' comments on IPM could be categorised into the following four recurrent themes: (1) severity of the medical problem, (2) impact of the medical problem on daily life, (3) impact of the medical problem on health status, and (4) expected (future) health risks. Patients with high IPM typically gave comments relating to high perceived severity of the problem, high impact of their problem on several aspects of life and negative impact on their current health status. Patients with high IPM (large sticker) emphasised the seriousness of their medical problem, the great interference with daily life, and its severe impact on their health status. Low IPM (small sticker) patients regarded their medical problem as relatively small, did not report any interference with daily life and experienced little influence on health status. Middle sized IPM gave statements in between (table 4b). Persons who chose the larger sticker size also feared more (future) health risks than individuals selecting smaller disk sizes. Comments on future health risks were only once raised by small IPM patients (see table 4b).

Convergent and divergent validity (PRISM-R2)

Table 5 represents the descriptive statistics and the correlations between the PRISM-R2 variables and the HMQ scales, the PDIS and the SCL-90 for the morbidly obese patients.

Table 5. Means en standard deviations of PRISM-R2, HMQ, PDIS, SCL-90 and correlations between SIS and IPM, and PRISM-R2 measures and HMQ, PDIS, SCL-90 (study 3)

		Mean	SD	SIS	IPM
PRISM-R2	SIS	26.4	22.8	-	-0.32*
	IPM	2.3	0.8	-0.32*	-
HMQ	Health status	27.0	7.5	0.31*	- 0.36**
	Life satisfaction	16.5	4.6	0.31*	- 0.51**
	Psychological well-being	28.7	7.0	0.29*	- 0.32*
PDIS	Illness intrusiveness (total score)	-4.6	21.8	0.27	- 0.41**
	Physical health	-1.1	1.5	0.00	- 0.31*
	Mental health	-0.7	1.7	0.29*	- 0.40**
	Diet	-0.6	1.7	0.14	- 0.15
	Life style	0.1	1.4	0.04	- 0.16
	Stress	-0.6	1.3	0.29*	- 0.33*
	Work	-0.4	1.6	0.18	- 0.40**
	Active recreation	-0.9	1.9	0.21	- 0.30*
	Passive recreation	0.4	1.4	0.25	- 0.20
	Financial situation	-0.5	1.3	0.24	- 0.36**
	Relationship with spouse	0.0	1.6	0.19	- 0.37**
	Sex life	-0.6	1.6	0.39**	- 0.37**
	Family relations	0.4	1.3	0.16	- 0.27
	Relationship with relatives	0.2	1.3	0.12	- 0.18
	Relationship with friends and acquaintances	0.3	1.5	0.15	- 0.34*
	Self-expression / Self-improvement	-0.1	1.8	0.25	- 0.40**
	Religious expression	0.1	0.9	- 0.23	0.31*
	Community and civic involvement	0.2	0.7	- 0.13	- 0.08
	Outlook on life	-0.1	1.7	0.31*	- 0.43**
	Character	0.1	1.8	0.30*	- 0.40**
	Trust in own body	-1.2	1.6	0.26	- 0.39**
SCL-90	Psychoneuroticism (total score)	4.4	2.1	- 0.24	0.41**
	Anxiety	4.2	1.6	- 0.18	0.29*
	Agoraphobia	4.9	1.1	- 0.31*	0.24
	Depression	4.6	1.9	- 0.27*	0.38**
	Somatic complaints	4.6	1.7	- 0.07	0.18
	Insufficiency in thinking and acting	4.3	2.0	- 0.19	0.42**
	Sensitivity	4.2	2.2	- 0.22	0.31*
	Hostility	5.0	1.1	- 0.15	0.17
	Sleeping problems	4.8	1.4	0.00	0.22

* $p < .05$, ** $p < .01$

SIS showed a significant positive correlation with all HMQ scales. In contrast, the PDIS total score and the SCL-90 (psychoneuroticism) did not significantly correlate with SIS. In only five out of the 20 PDIS-items and two out of eight subscales of SCL-90 a small tot moderate correlation could be demonstrated with SIS.

The correlations of IPM with all three HMQ scales (negative), the total PDIS score (negative), and the total SCL-90 score (positive) were significant. Fourteen out of the 20 PDIS-items and four out of eight subscales of SCL-90 showed a significant negative correlation with IPM. Finally, a significant negative correlation was found between SIS and IPM (r = -.32; p < .05).

DISCUSSION

Although suffering is considered a very relevant concept in medicine, until now hardly any effort has been made to develop a measuring instrument. The original PRISM task has yielded some promising and consistent preliminary results[5,7]. Its application as a measure of suffering was discovered by serendipity[5] and to date, no attempt has been made to modify or revise the task. In the present study, we evaluated two revised versions of PRISM. In Study I respondents were asked to choose one of three different sizes of the illness-disk before completing the original PRISM task. Study II assessed the sensitivity to change of PRISM-R1. In Study III, further validation data were gathered for PRISM-R2, in which the self-disk was placed in the centre of a 'life' circle. The pattern of correlations between the PRISM variables, SIS and IPM, and with the other well-being measures, as well as the qualitative data, confirm that patients interpret the task rather consistently, yielding meaningful results. As with the original PRISM task, this is very likely due to the simplicity of the instructions, and the lack of complexity of the task itself.

The data from the different patient groups revealed some intriguing dissimilarities. Whiplash and infertility patients in Study I obtained low SIS values, as compared to the other patient groups, which suggests that these two groups tend to suffer more from their medical problems than the other patients. This fits well with Cassell's concept of suffering[1], because infertility may have a strong negative impact on self-esteem, on well-being as well as on the partner relationship[27]. Among women who wish to bear a child, infertility is likely to be seen as a defining and very negative aspect of the 'self' and one's female identity, and hence a cause of suffering. The whiplash patients in the current study were patients with severe and complex enduring complaints, representative of the chronic whiplash patient population at large. The significantly elevated levels of suffering in this

group relative to the other patient groups might be explained by some of their specific characteristics. Whiplash is typically caused by trauma (e.g., a car accident) resulting in a sudden onset of symptoms. In comparison with patients suffering from an organic disease, whiplash patients do not have time to gradually adjust to their situation. In addition, whiplash patients generally blame others for their physical problems and see themselves as victims. This self-victimisation may easily lead to feelings of anger, resistance, and reluctance to take responsibility for their recovery process and unwillingness to readjust life goals and expectations. According to Main et al.[28] whiplash patients not seldom display a so-called assimilative coping style: rigidity in sustaining former objectives, resulting in distress, muscle tension and elevated pain levels. Whiplash patients also often feel that they are not taken seriously by their social surroundings and the medical establishment. Being diagnosed by numerous medical specialists, having received several diagnoses and having been subjected to a wide variety of treatments generally with little effect, patients are often left confused, frustrated, angry and in distress[28]. Finally, inadequate pain behaviour could be fostered by this lack of recognition and social support. This perception probably prevents these patients to give meaning to their experiences, which may enhance their suffering, as reflected in the rather extreme PRISM-R1 findings of this group.

In Study I significant associations were also found between the IPM (PRISM-R1) and the HMQ variables. The relation between SIS and IPM with the HMQ variables provide preliminary support to the validity of these PRISM measures and demonstrate that it can be used as a generic measure for suffering. Another important finding is that the PRISM-R1 variables both appear to be sensitive to change (study II) and therefore can be applied successfully in treatment evaluation studies. The changes found were significant and according to expectations. More precisely, after the intervention, IPM became smaller whereas SIS increased. In future studies, the assessment and interpretation of these changes should be critically examined by interviewing patients about the specific effects of the treatment on several aspects of their life.

In the study with morbidly obese patients, the majority (81.8%) placed the illness-disk totally (25.5%) or partially (56.4%) on top of the self-disk. Although there are currently no data available of morbidly obese patients on the PRISM-R1 to compare with, it seems that the interpretation of the self-disk placed in the middle of a large printed circle (PRISM-R2) indeed resulted in less confusion about the central point in life as compared with the original PRISM. Regarding the improved distinctness in the interpretation of the task, together with the large difference in SIS-range of the PRISM-R1 (0-202 mm) compared to PRISM-R2 (0-93 mm), it is not possible to compare data obtained with these two different versions with each other. Nevertheless, we definitively prefer PRISM-R2 over

PRISM-R1.

In Study III, considerable associations were found between IPM and HMQ scales, PDIS and SCL-90 subscales. In addition, the comments of the morbidly obese patients about the cognitive processes leading to the choice for one particular illness-disk size revealed that IPM in particular was associated with the perceived severity and impact of the medical problem on current health status and interference with daily life. These topics seem to fit nicely Cassell's conceptualisation of suffering as "the state of severe distress associated with events that threaten the intactness of the person"[1]. They also come close to the Frank's[29] description of suffering "....a reality one cannot come to grips with, ...a sense that something is irreparably wrong with one's life". One should be reluctant to formulate more specific predictions about the strength of the associations between IPM and the other measures (HMQ, PDIS, SCL-90), since it is understandable that some patients may not suffer, while having a severe disease, whereas others may suffer considerably from apparently minor symptoms. For morbidly obese patients significant correlations were found between SIS and all HMQ scales, but only for a few of the PDIS-items and SCL-90. The items which correlated significantly with SIS were also, in a reversed way, significantly associated with IPM. Previous PRISM studies have shown that the SIS measure correlated well with physical functional impairment, depression and coping resources[5,30]. The positive association between mental health and SIS was also found in our study. However, in the morbidly obese patients, no clear link between SIS and the subjective evaluation of both physical and mental health as measured with the PDIS was found. IPM on the other hand did show a positive correlation with these items. This can be partly explained by the overlap in what SIS and IPM measure, possibly causing IPM to assess constructs partially overlapping with those measured by SIS. On the other hand, considering the qualitative data of this study, 'health status', referring to both physical and mental health, was an important and consistent theme mentioned by the obese patients with high IPM and low SIS.

The qualitative SIS data focused mainly on the impact on daily life and current health status. These responses were in several respects quite similar to the comments that were made regarding IPM, which demonstrates that there is a clear overlap in what SIS and IPM are measuring. However, in contrast to IPM comments, the SIS comments also often specifically referred to a relationship of the medical problem with 'self' and/or significant others. Thus, the distance between 'self' and the illness (SIS) seems to be more likely additionally related especially to the social impact of morbid obesity. This hypothesis has face validity, because the SIS task requests patients to visualise the relation of the illness with 'self' and the outside world.

For the evaluation of the relationship between IPM and SIS on both revised PRISM versions, the

following considerations deserve attention. First, IPM and SIS were only slightly or moderately negatively related to each other, which means that, generally spoken, the size of the medical problem disk becomes bigger when it is placed closer to the self. Second, IPM shows stronger, although still moderate, associations with the HMQ, PDIS and the SCL-90 than SIS. One may wonder whether the introduction of IPM as an additional variable may have affected the sensitivity of the SIS measure. Possibly, the order of the PRISM-R tasks could have had a more than subtle influence on the original SIS measure. To test whether the task of selecting an illness-disk size before completing the original PRISM task indeed affects the SIS measure, one can ask patients first to conduct the original PRISM task (with just one illness disk), and only after that task has been completed provide them with the opportunity to increase, decrease or maintain the size of the disk. A second group of comparable patients should conduct the PRISM-R tasks as done in the present study. If these two conditions yield significant differences, it must be concluded that the introduction of IPM indeed affects the meaning of the SIS measure. Third, comparing pre- and post treatment findings reveals that, either due to intervention or just to the passage of time, whiplash patients report significant improvement in subjective health status and psychological well-being, which is accompanied by both an increase in SIS and a decrease in IPM.

More research is needed to understand the meaning that patients give to both PRISM variables, as well as what happens when certain aspects of the task are altered. We further fully agree with Büchi et al.[7] that the lack of a gold standard for these concepts is a serious problem. Therefore, in addition to getting more insight into the relationship with quality of life and well-being measures, there is also a strong need of new conceptualisations and operationalisations of suffering and more data on the associations between suffering and perceived illness severity and, on the other hand, disease variables, personality factors, and how the person appraises and copes with his/her health problems (e.g., controllability, illness intrusiveness, optimism, coping resources, etc). One may further consider to design a study aimed to examine the relationship between PRISM scores and specific behaviours (e.g., crying and other indices of distress; see for example Troisi & Moles[31]). The present studies, using the two revised versions of the PRISM, have demonstrated that SIS and IPM provide interesting and relevant additional information on important aspects of the patient's illness experience. From the statements it is clear that interference of the medical problem with several aspects of life including social aspects, the uncontrollability of the problem and fear for future diseases, determines the SIS and IPM scores significantly. Although suffering is associated with a perceived lack of control, an inability to attach meaning to one's experience, and fear for the future, it is not clear whether the current versions of the PRISM tap the entire concept of suffering.

Some limitations of our studies have to be taken into account. First, with the exception of the results of Study II, our data are all cross-sectional. However, the results of Study II indicate that the PRISM-R variables change significantly, after treatment, in the predicted direction. Second, some of the patient samples were rather small and hence our results could be subject to Type II statistical errors. Third, we did not compare results obtained with the revised PRISM tasks with data obtained with the original PRISM task for the same patients, because the nature of the task makes it difficult if not impossible for patients to complete different versions consecutively without the possibility of introducing bias. We also did not study the possible difference in completing the PRISM task with oral instruction (original version of the PRISM) as compared to the written instructions given in our study. As the task is easy to understand, we don't think this will have caused much bias. Another limitation of our study is that, in the absence of a gold standard measure of suffering, definitive validation of the different PRISM versions is difficult. The best that can be achieved is to examine whether, in relation to other psychological and physical variables, the variables derived from the PRISM behave as may be expected of a quantitative measure of suffering.

The revised versions of the PRISM seem to measure more details as compared to the original version of the PRISM. Moreover, the PRISM-R2, placing 'self' in the middle of ones living environment, makes interpretation for the patient more straightforward. By offering a test without any specific questions, the PRISM-R1 and PRISM-R2 may be assumed to evaluate individually determined, inarticulate aspects of suffering and illness severity, which may be useful in the clinical setting, the evaluation of interventions, and other research. One could argue that this method allows patients to base their evaluation on very idiosyncratic issues and subjectively weighing different aspects of their disease. This fits well Frank's description of suffering as "a lived reality that resists articulation"[29]. The revised PRISM may therefore offer the possibility to start a conversation with patients on relevant aspects of their illness, which otherwise probably would be left not discussed. The present preliminary, but challenging findings suggest that, in particular patients with high IPM and low SIS, deserve special attention of health care providers. Future research, however, is needed to substantiate this claim.

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Chapter 5

Weight-related quality of life in adolescents. Psychometric evaluation of the Dutch translation of the IWQOL-Kids

Adaptation of: Wouters EJ, Geenen R, Kolotkin RL, Vingerhoets AJ. Met lichaamsgewicht samenhangende kwaliteit van leven bij adolescenten. Psychometrische kwaliteit van de Nederlandse vertaling van de IWQOL-Kids. Tijdschrift voor kindergeneeskunde. In press.

ABSTRACT

Aim: To evaluate the psychometric qualities of the Dutch translation of the Impact of Weight on Quality of Life-Kids (IWQOL-Kids), a measure to assess the body weight related quality of life in adolescents (age 11 – 19 years).

Method: The IWQOL-Kids was completed by 104 adolescents. In addition weight and height were measured. To examine convergent validity, associations with the Pediatric Quality of Life Inventory (PedsQL), a generic health-related quality of life questionnaire, were determined. The sensitivity to change was established after summer camp participation.

Results: Internal consistency coefficients were high for three out of four scales (Cronbach's α .81 to .82) and moderate (.66) for one scale. Convergent validity was confirmed by the pattern of correlations between scales of the IWQOL-Kids and the PedsQL. The IWQOL-Kids discriminated among weight classes and showed responsiveness after the summer camp.

Conclusion: Results suggest that the IWQOL-Kids is a useful instrument to measure weight-related quality of life in adolescents.

INTRODUCTION

Obesity is a growing problem in children and adolescents, worldwide and in the Netherlands[1-3]. In the Netherlands, the prevalence of obesity in children has increased fivefold during the past 20 years[1]. The risk to develop health problems, e.g., cardiovascular, metabolic and orthopaedic problems, is significantly increased in obese children[4-6]. In addition, obesity is associated with psychosocial problems like low self-esteem, social rejection and being bullied[7, 8]. Thus, obesity impacts quality of life considerably[9-11].

Health-related quality of life is defined as the impact of a disease or health problem on physical, psychological, and social well-being from the patient's perspective[12]. To assess this construct in children, generic measurement instruments such as the Paediatric Quality of Life Inventory (PedsQL)[13] and disease specific questionnaires are available for several health problems. Disease specific instruments focus on those problems specifically relevant for the disease and are more sensitive to change during the course of the disease and after intervention compared to generic instruments[14].

Obesity is a chronic health problem with a complex aetiology and treatment and the chance of sustained weight loss decreases with age[15]. Not only weight loss, but also improvement of quality of life is an important treatment goal in obesity. In order to assess the effect of interventions on quality of life, a valid measure is mandatory.

As assessed with generic instruments, health-related quality of life in obese children and adolescents is substantially reduced[16]; children with overweight, compared to normal weight children, and children with obesity, compared to overweight children, show decreased quality of life scores in the physical, more than in the psychosocial and emotional, domain[17]. Studies in obese adults underscore the advantage of using obesity specific questionnaires to be able to more accurately assess the influence of overweight and obesity in the psychosocial and emotional domains[18, 19]. A Dutch obesity specific questionnaire will be a valuable addition to existing measures to assess quality of life in obesity, and to evaluate treatment in obesity. Currently no obesity specific instrument was available for children and adolescents in the Dutch language.

The Impact of Weight on Quality of Life-Kids (IWQOL-Kids) originates from an American measurement instrument and has been developed for adolescents between 11 and 19 years of age. To date, the IWQOL-Kids is the only questionnaire measuring weight related quality of life in adolescents[20]. The questions in the American instrument were selected from 73 items, based on literature of quality of life in adolescents, clinical data and the adult version, the IWQOL-Lite. Pilot

testing in 642 adolescents resulted in the current instrument containing four factors and 27 items[21]. The American instrument has good psychometric properties[21].

The aim of the present study is a preliminary evaluation of the psychometric quality of a Dutch translation of the IWQOL-Kids. With respect to convergent validity, it is expected that the strongest correlations will be found between the physical comfort scale of the IWQOL-Kids and the physical scale of the PedsQL, between the body esteem scale of the IWQOL-Kids and the emotional scale of the PedsQL, and between the social life scale of the IWQOL-Kids and the social scale of the PedsQL. For sensitivity to change, it is expected that the 'body esteem' scale will be most reactive, because of the aim of the specific intervention that was evaluated.

METHODS

Translation

The IWQOL-Kids was translated and back-translated, following the usual procedure[22]. Two pairs of Dutch experts in the field of obesity independently translated the questionnaire into Dutch. Subsequently the two translations were compared and if necessary adapted. In the next step the questionnaire was translated back into English by a bilingual psychologist. Discrepancies between the original and back-translations were discussed and the definitive version was decided by consensus. The definitive questionnaire was offered to and discussed with 25 children (age ranging from 11 – 14 years) to check if the interpretation of items was unequivocal. No adaptations were needed as a result of this pilot.

Participants

One hundred and four adolescents with and without overweight between 11 and 19 years completed the IWQOL-Kids. Children within the age range without co-morbidities that required paediatric supervision were eligible. None of the eligible children or their parents denied participation. The participants' characteristics are shown in table 1. The overweight children participated in a lifestyle programme (Real Victory), were member of a swimming club (only one child fulfilled the minimum age criterion), or participated in a special two week summer camp developed for overweight and obese adolescents, aiming at improving their self-esteem (Victory for Life). Normal weight children were members of a volleyball sports club. Underweight children were excluded from the study. In

total 25 normal weight, 19 overweight and 62 obese adolescents participated. Body Mass Index (BMI) was calculated by dividing weight (kilograms) to the square length (metres). Age and sex standardised BMI (zBMI) was calculated following international guidelines[23]. Normal weight was defined as a zBMI between the 10th and 85th percentile; overweight as a zBMI between 85th and 95th percentile; obesity as a zBMI above the 95th percentile[23].

Table 1. Characteristics of the participants

Source	Number	zBMI (M ± SD)	Age (years) (M ± SD)	Sex (M/F)	Education level[a] (%)			
					1	*2*	*3*	*4*
Volleyball sports club	24	-0.1 ± 0.6	14.3 ± 1.6	12/12	0	4	38	58
Lifestyle intervention	20	1.8 ± 0.4	13.4 ± 1.6	8/12	0	45	40	15
Summer camp	61	2.0 ± 0.4	13.9 ± 1.7	16/45	4	22	45	29
Swimming club	1	1.80	12.0	0/1	100	0	0	0

zBMI = age and sex standardised BMI
M ± SD: Mean ± Standard Deviation
[a]Education level: *1* = special care primary education; *2* = usual primary education; *3* = lower secondary education; *4* = higher secondary education

Procedure

Trained research assistants measured length and weight out of sight of other participants. The IWQOL-Kids and the PedsQL were filled out by participants under supervision of the research assistants. Participants of the summer camp completed the questionnaires both on the first day and on the last day of their stay, in order to establish if the instrument could register changes. This study received permission from the Ethical Board of Tilburg University.

Measurements

IWQOL-Kids

The IWQOL-Kids comprises 27 statements with answering categories, ranging from 'always'(1) to 'never'(5). For each statement the answer best fitting the past seven days situation is encircled. There are four scales. The 6 item 'physical comfort' scale measures physical discomfort as a result of overweight and related physical disabilities. An example question is: 'because of my weight I avoid using stairs whenever possible'. The 'body esteem' scale (9 items) addresses preoccupations

with weight, physical appearance and feelings one has about oneself and one's body. An example question is: 'because of my weight I try not to look at myself in mirrors or in photographs'. The 'social life' scale (6 items) assesses the perception of acceptance by others and the ease or difficulty to make friends. An example: 'because of my weight people stare at me'. The scale 'family relations' consists of six statements about treatment by family members in relation to one's overweight. An example question is: 'because of my weight family members make fun out of me'. The four scale scores are calculated by summation of the item scores and transformation into a scale with zero as the worst and 100 as the best possible score. A total quality of life score can also be calculated. Filling out the IWQOL-Kids takes about eight minutes.

PedsQL

The PedsQL is a generic quality of life measurement instrument, which can be used for several age groups[13]. It has four subscales: 'physical', 'emotional', 'social' and 'school', and also a total score can be calculated. Here also the scores range between 0 and 100, a higher score representing better quality of life. The PedsQL is a frequently applied, valid and reliable instrument, available in several languages[13].

Anthropometry

Height was measured to the nearest 0.5 cm (Seca 214) and weight to the nearest 0.1 kg (Seca 761), adolescents wearing light clothes and without wearing shoes.

Education level

Four education levels were distinguished: level 1 represents special care primary education, level 2 usual primary education, level 3 lower secondary education, level 4 higher secondary education.

Statistics

Table 2 represents relevant concepts for testing the psychometric quality of a measurement instrument[24]. As a measure of internal consistency Cronbach's α was calculated. Values above 0.70 represent good internal consistency[24]. Spearman correlations were used to test convergent validity of the four IWQOL-Kids scales. Correlations between scale scores and zBMI were also calculated. In order to test the sensitivity of the IWQOL-Kids, differences between the scores of different weight groups (normal weight, overweight and obesity) were tested with the Kruskal-Wallis test, because of the small sample of normal weight children. Additionally, scale changes were

calculated for a subset of adolescents participating in the summer camp (Wilcoxon Signed-rank test for paired observations). We used non-parametric testing because the variables 'social life' and 'family relations' were not normally distributed. Also, floor- and ceiling effects were evaluated. If more than 15% of the respondents obtained the highest or lowest score, this was considered an indication of a lack of responsiveness at one scale end[24]. A change in scale score of more than 7.7 was regarded as a meaningful change[25]. SPSS version 16 was used for all analyses. Alpha values below 0.05 were considered statistically significant.

Table 2. Concepts relevant for psychometric evaluation of measurement instruments

Concept	Characteristic
Convergent validity	The degree of correlation of two instruments designed to measure comparable constructs
Internal consistency	The degree of correlation between different items in one (sub)scale
Discriminative ability	The degree of distinction between (sub)groups
Sensitivity to change (responsiveness)	The degree to which changes can be measured
Floor and ceiling effects	A disproportionate percentage lowest or highest scores

RESULTS

Internal consistency

Internal consistency was good for three scales of the IWQOL-Kids, with Cronbach's α values of .92 for 'body esteem', .89 for 'social life' and .91 for 'family relations'. Internal consistency for 'physical comfort' was moderate (Cronbach's α = .66).

Construct validity

As expected, correlations between scales of the IWQOL-Kids and PedsQL with statements from comparable domains, were highest (table 3), which is an indication of convergent validity.

Table 3. Spearman correlations between the scales of the Impact of Weigh on Quality of Life for Kids (IWQOL–Kids) en de Paediatric Quality of Life Inventory (PedsQL)

	IWQOL-Kids				
	Physical comfort	Body esteem	Social life	Family relations	Total score
IWQOL-Kids					
Physical comfort					
Body esteem	.65				
Social life	.59	.67			
Family relations	.20	.35	.42		
Total score	.76	.94	.84	.44	
PedsQL					
Physical	**.63**	.56	.50	.27	.61
Emotional	.41	**.67**	.57	.33	.68
Social	.50	.59	**.61**	.28	.63
School	.40	.47	.42	.36	.52
Total score	.58	.73	.66	.38	**.77**

Discriminative ability

All scale scores of the IWQOL-Kids showed negative associations with the zBMI ($p < .001$): 'physical comfort' ($r = -.68$), 'body esteem' ($r = -.57$), 'social life' ($r = -.53$), 'family relations' ($r = -.30$) and total score ($r = -.63$). There was little overlap between the interquartile ranges of the overweight and obese groups for the 'physical comfort' and 'total' scale scores. No overlap was found between the normal weight and the overweight groups (table 4).

Table 4. Median and interquartile range of the Impact of Weight on Quality of Life Kids (IWQOL-Kids) per weight group

	Normal weight (n = 25)		Overweight (n = 19)		Obesity (n = 62)	
	Median	Interquartile range	Median	Interquartile range	Median	Interquartile range
Physical comfort	100	100-100	96	92-100	88	79-96
Body esteem	100	100-100	83	67-86	67	50-83
Social Life	100	100-100	92	83-96	88	67-96
Family relations	100	100-100	100	96-100	100	92-100
Total score	100	100-100	90	84-94	81	68-89

Responsiveness to change

Participants of the two week summer camp (n = 55) had a modest weight reduction after the camp: mean BMI decreased 0.75 (range of the change: + 0.25 till -2.10, standard deviation 0.35, p < .001). In two IWQOL-Kids scale scores and the total score an improvement was found (figure 1). On the 'body esteem' (p < .001) and on the total score (p < .001), this improvement was statistically significant.

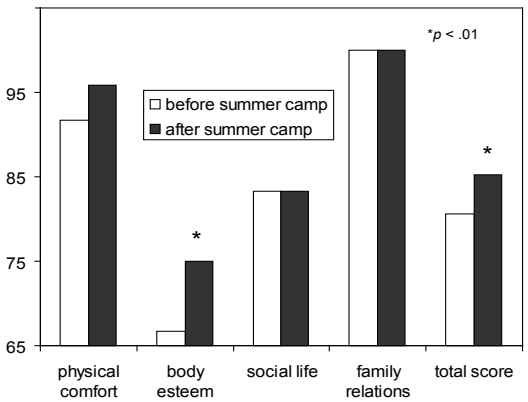

Figure 1: Median scores of the IWQOL-Kids questionnaire before and after the summer camp (median values, n = 55).

Floor- and ceiling effects

Maximal scores in the overweight and obesity groups were found in 21% of participants on the 'physical comfort' scale, 1% of the 'body esteem' scale, 14% of the 'social life' scale, 63% of the 'family relations' scale and 0% of the total score.

Clinical relevance

For all scales differences between obese and normal weight IWQOL-Kids scores were clinically relevant (> 7.7). Between the overweight and obese group relevant differences were found for 'physical comfort', 'body esteem', and the total score. The overweight and normal weight children differed on the scales 'body esteem', 'social life', and total score (table 4).

DISCUSSION

This study was designed to study validity and reliability of the Dutch translation of the IWQOL-Kids. For three out of four scales, internal consistency proved to be good. Internal consistency of the 'physical comfort' scale was moderate, possibly as a result of the smaller distribution on these scale scores in this relatively healthy group. Considering internal consistency, the IWQOL-Kids is a reliable instrument.

The strong associations between scales of the IWQOL-Kids and the PedsQL, a widely used and valid instrument, confirmed construct validity. The correlations were comparable to those found between the de IWQOL-Kids and the PedsQL in the original version[21]. Evidence for discriminant validity was provided by the high correlation ($r > .50$) between the scales of the IWQOL-Kids and body weight of the children, and was somewhat stronger compared to the American validation study[21]. Only the scale covering bullying within the family was less convincing. The majority of participants had maximal scores, which indicates that bullying within the family does not occur in the studied population. In the American IWQOL-Kids study, participants also scored relatively high on this scale (mean 90 in obese adolescents and mean 94 in overweight adolescents) and the association with body weight was weakest[21]. It is also possible that our participants scored favourably, because they were selected from the general population and not from clinical groups.

Sensitivity to change was measured in a subset of participants. Especially preoccupations by weight, physical appearance and perceptions of oneself and one's own body changed after two weeks of summer camp, which aimed at improving self-esteem. This specific goal seems to be reached. For a stronger indication of the sensitivity to change on all scales, also interventions with other goals, as well as longer lasting interventions, should be evaluated.

Disease specific and generic quality of life measurement instruments both have their specific advantages and disadvantages. In order to compare quality of life of obese children to children with other health problems, generic instruments are to be preferred. In order to measure changes or to discriminate between subgroups within the group of overweight adolescents, obesity specific instruments are more appropriate. For research purposes, depending on the research question, a combination of both types of instruments is advisable. The IWQOL-Kids and our study have some limitations. The IWQOL-Kids has been developed for adolescents 11 till 19 years of age, but for younger children no instrument is available. To solely rely on proxy measures, e.g., by the parents, is not satisfactory, because children and adolescents tend to report more positively on their functioning as compared to their parents[26, 27]. An optimal procedure would consist of self report

combined with proxy measurements (e.g., a parent or a teacher). Furthermore, in our study test-retest reliability was not tested and the sensitivity to change was only partly evaluated. An important limitation of the IWQOL-Kids is the ceiling-effect, especially in the 'family relations' scale. Research in a clinical group might show if this scale has additional value.

This study was a preliminary evaluation of the psychometric properties of the IWQOL-Kids. The instrument has a moderate to good internal consistency, construct validity, discriminative capacity and sensitivity to change. The Dutch IWQOL-Kids therefore seems to be a useful instrument to measure obesity specific quality of life in adolescents between 11 and 19 years. The usefulness in clinical populations, and responsiveness to change due to interventions, have to be established in future research.

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Part II

PSYCHOLOGICAL DETERMINANTS OF PHYSICAL ACTIVITY IN OBESITY

6

Chapter 6

Setting overweight adults in motion: the role of health beliefs

Wouters EJ, van Nunen AM, Vingerhoets AJ, Geenen R. Setting overweight adults in motion: the role of health beliefs. Obes Facts 2009;2:362-369.

ABSTRACT

Objective: Health beliefs of overweight adults who did and did not enter an exercise programme were compared to identify possible factors that hamper people to enter such a programme.

Method: Participants (*n* = 116, 78 women and 38 men) were overweight adults without comorbidities. Self-report instruments examined the burden of suffering, beliefs related to physical exercise and obesity, somatic complaints, and obesity-related quality of life of new participants of exercise programmes versus sedentary non-exercisers.

Results: The mean body mass index of exercisers and non-exercisers was 34.6 (7.0) and 32.8 (5.8) respectively. Fear of injury was higher and perceived health benefits of exercise were lower in the non-exercisers, who also more often believed their overweight to be irreversible and attributed overweight to physical causes. The burden of suffering, somatic complaints, and quality of life of the groups were not significantly different. Fear of injury remained a significant predictor of belonging to the non-exercise group after controlling for other variables and multiple testing.

Conclusion: Research is needed to examine whether the inflow of overweight people in exercise groups increases when health beliefs are recognised, considered, and discussed both in interventions and in public health campaigns promoting physical exercise in sedentary, overweight people.

INTRODUCTION

Overweight and obesity have become prevalent problems[1, 2]. Obesity is a risk factor of chronic diseases such as diabetes type 2 and cardiovascular disease[3]. Physical exercise programmes have been demonstrated to reduce weight, to support preservation of the reduced weight[4-8], to reduce obesity-related health risks[9], and to improve mental health[10-12]. Although physical exercise is beneficial beyond doubt, and large physical activity promotion programmes have been implemented[13, 14], the majority of overweight persons does not engage in sportive activities[15]. In order to stimulate sedentary overweight persons to exercise, it is necessary to have insight into the characteristics that may hamper them to enter physical exercise programmes.

Several theories specify determinants of health behaviour. Two influential models have motivated the choice of variables in the current study: the health belief model[16, 17] and self-regulation theory[18]. The health belief model states that the practice of a health behaviour can be understood by knowing whether the person perceives a health threat as well as health benefits from a particular practice to reduce that threat. Four elements determine health practices: perceived threat, barriers, benefits and cues to action[16]. 'Threat' refers to susceptibility, the perception of one's personal risk for contracting a certain health condition, and the perceived severity of this condition. Indeed, a major motivation of obese patients for seeking treatment in medical centres has been the threat of future health risks[19]. 'Barriers' in the health belief model are the possible negative consequences of particular health actions such as considering exercising risky, irrelevant, or unnecessary[20-22]. Other barriers applying to overweight are not being a sporty type, feeling lack of confidence or embarrassment to be seen exercising[23, 24], regarding oneself as unacceptably overweight[25], and the experience that exercise does not provide much pleasure[20, 26]. 'Benefits' in the health belief model refer to the believed effectiveness of strategies to reduce the threat[17]. Perceived benefits of exercise predict physical exercise following counselling in primary care[27, 28]. 'Cues to action', the final element of the health belief model, can be any event both physical, e.g., disease symptoms, or environmental, e.g., illness in relatives, which motivates a person to change his or her lifestyle behaviour. Also a perceived decrease in quality of life might be a cue to action. Quality of life is on average substantially impaired in obesity[29, 30], and improves after weight reduction[31]. Reduced quality of life and higher weight have been related to treatment seeking behaviour in obesity[32, 33], but it is not clear whether this also pertains to the willingness to enter a physical exercise programme. All together there is reason to believe that threats, barriers, benefits and cues to action may influence the motivation of sedentary overweight persons to increase their physical activity.

Besides the perception of health threats and benefits, other beliefs determine health behaviour. Self-regulation theory distinguishes five illness representations or cognitions about the illness[18]: 1) identity, the label of the threat, e.g., obesity and its symptoms, 2) timeline, the prognosis and changeability of the problem, 3) cause, the supposed origin, e.g., somatic/genetic or stress-induced, 4) consequences, the effects such as reduced functioning and 5) cure-control, the extent to which the health problem can be cured, prevented or kept from progressing. The predictive value of self-regulation cognitions in obese persons has been confirmed for the effect of dietary intervention[34]. The more one considered obesity to be unchangeable and to have a somatic rather than a behavioural origin, the more difficult it appeared to be to change one's behaviour. If and how this applies to sedentary adults to start physical exercise is not known.

To be better able to incite overweight persons to enter an exercise programme or to increase their physical activity level in another way, the aim of the present exploratory study was to identify the possible factors that hamper people to start a physical exercise programme. For this purpose, we compared psychological scores of overweight, but otherwise healthy adults who did and did not participate in a physical exercise programme. Several socio-demographic variables were examined as covariates due to their possible influence on motivation to engage in sportive activities, notably age and gender[35], education level[36], baseline physical activity[20], (disappointing) dietary experiences[37, 38], and obesity of the parents[39].

It was hypothesised that the following factors are related to starting physical exercise: considering overweight as a serious health problem (threat), the absence of fear of injury or embarrassment (barriers), a positive attitude towards exercise and confidence in exercise abilities (health benefits), with a higher body mass index, more health complaints, a lower perceived quality of life and more suffering (cues), together with realistic self-regulative cognitions toward overweight.

METHOD

Participants and procedure

From April 2006 until December 2007, 58 participants who started exercising for the first time and 58 non-exercising (sedentary) overweight persons entered this study. Inclusion criteria were: age between 18 and 65 years, no serious health problems needing medical attention, a Body Mass Index (BMI) of 25 kg/m² or more, and (for the non-exercisers only) no intention to reduce weight or improve health by any means including exercise since at least one year. The exercisers entered

an exercise programme in one of six participating fitness centres predominantly in the Eindhoven region, the Netherlands. The centres did not focus on body building, but aimed at clients who wanted to improve their general health. The exercising participants filled out the questionnaire before the actual start of the exercise programme. The non-exercising group was recruited through advertisements (n = 6), the website of the Dutch Obesity Society (n = 10), large sizes fashion shops (n = 16), general practitioners (n = 10) and acquaintances of the authors (n = 16). Participants were informed about the general purpose of the study, being "research on physical and psychological aspects of physical activity in overweight persons". Participants were volunteers, received no compensation for participation, and gave written informed consent before participating. One of the adults from the non-exercising group who were asked to participate and who met the inclusion criteria, refused participation for unknown reasons. The study was approved by the research and ethics committee of the Reinier van Arkel Group, 's-Hertogenbosch, the Netherlands.

Measures

General characteristics

Information about dieting history was obtained with questions such as 'have you tried to lose weight in the past?', and 'how long did your weight loss attempts last on average?' Information of occurrence and extent of overweight in father and mother, was obtained with two questions. An example question is: 'was your biological father overweight at any time during his life and if so, to what extent?' Respondents answered with a 5-point scale response format, ranging from 'no overweight' to 'more overweight than mine'. Recent and current exercise behaviour was measured by asking 'do you engage in sportive activities?' (answering possibilities yes or no), an open ended question about the nature of these activities, and the time spent to these activities weekly during the past year, using a 5-point scale response format ranging from 'less than one hour per week' to 'more than four hours per week'. Walking and cycling activities during daily life like shopping, going to work or going to school, were rated on a five point scale, ranging from less than five minutes per day to more than 45 minutes per day.

Suffering

Suffering and perceived medical problem were measured with the Pictorial Representation of Illness and Self Measure, 2nd revision (PRISM-R2)[40, 41]. The PRISM-R2 consists of a rectangular (A4) sheet of paper, with a large (diameter 186 mm) circle depicting the persons life environment, with a yellow disk in the middle (diameter 52 mm), representing the person's 'self', and three differently

sized (35, 52 or 65 mm) separately provided auto-adhesive disks representing the medical problem (in this study overweight or obesity). Participants are asked to choose which of these three disks best mirrors how they perceive their overweight. A larger size of this medical problem disc (IPM: Illness Perception Measure) represents more perceived severity of the overweight problem and applies to the 'threat' concept of the health belief model. Having chosen the most appropriate disk, they attach it to the paper sheet in such a way that it best typifies the participant's current view of the place of the medical problem in her or his life. A smaller distance between the centres of the 'self' and medical problem disks (SIS: Self-Illness Separation) indicates more suffering, and is considered as a 'cue to action' in the health belief model. The feasibility and validity of the variables assessed by the PRISM-R2 in measuring aspects of suffering in obesity have been supported[41].

Physical exercise beliefs

Perceived benefits and barriers of physical exercise were measured with the Physical Exercise Belief Questionnaire (PEBQ)[22]. This 16-item questionnaire, which is partly based on the Dutch version of the Tampa Scale for Kinesiophobia (TSK)[22] consists of four scales. Two scales assess barriers to physical exercise: fear of injury (e.g., 'sports are dangerous for me because I easily get injured') and embarrassment (e.g., 'I feel ashamed of my body when doing sports'). Two other scales measure perceived exercise benefits (e.g., 'sports are healthy for me') and confidence (e.g., 'I am a sporty type of person'). The 5-point Likert-rating format ranges from 1 (strongly disagree) to 5 (strongly agree). The psychometric characteristics of the PEBQ have been found to be satisfactory[22]. In the current study, Cronbach's α values were 0.65 for exercise benefits, 0.93 for embarrassment and 0.80 for fear of injury and confidence.

Somatic complaints

Somatic complaints were assessed with a questionnaire listing 10 obesity related complaints (e.g., joint problems, back complaints, varicose veins, fatigue). This questionnaire has a 5-point rating format, ranging from 1 (not at all) to 5 (very much).

Quality of life

Quality of life was measured with the Impact of Weight on Quality of Life-Lite questionnaire (IWQOL-Lite), which contains five scales: physical function (e.g., 'because of my weight I have trouble using stairs'), self esteem (e.g., 'because of my weight I am embarrassed to be seen in public places'), sexual life (e.g., 'because of my weight I do not enjoy sexual activity'), public distress (e.g., 'because of my weight I experience ridicule, teasing, or unwanted attention') and work (e.g.,

'because of my weight I am afraid to go on job interviews')[42]. The total score summarises the overall impact of overweight on quality of life. The IWQOL-Lite has been proven to be a reliable and valid instrument to measure obesity related quality of life in both community and treatment samples of obese persons[42]. Cronbach's α coefficients in our sample were 0.73 for work and between 0.88 and 0.94 for the other four scales.

Obesity cognitions

Obesity cognitions were studied with the Obesity Cognition Questionnaire (OCQ)[43], an obesity adapted version of the Illness Perception Questionnaire (IPQ)[44]. The OCQ consists of 25 items and four scales for timeline, physical cause, behavioural cause and psychological consequences. High scores on timeline reflect a pessimistic perception of the prognosis of one's overweight. High scores on physical cause and behavioural cause indicate that one considers physical and behavioural causes of obesity important, respectively. High scores on psychological consequences reflect the psychological impact of obesity[45]. The psychometric properties of the OCQ are adequate. In our study the scales had a moderate to high internal consistency; Cronbach's α ranged from 0.66 for physical origin and 0.80 to 0.82 for the other scales.

Statistical analyses

With exception of the scores on the IWQOL-Lite and number of complaints, the scores were normally or nearly normally distributed according to common criteria[46]. Participants' characteristics and the study variables of the exercise and non-exercise groups were statistically compared with Chi^2 tests in case of nominal variables, with non-parametric (Mann-Whitney *U*) tests in case of the not normally distributed variables, and independent samples *t*- test in case of the other variables. The magnitude of differences was computed (Cohen's *d*) in normally distributed variables[47]; these effect sizes express the magnitude of differences between groups in standard deviation units. Effect sizes from 0.2 to 0.5, from 0.5 to 0.8 and greater than 0.8 are considered small, moderate and large, respectively. A logistic regression analysis was performed to identify factors that significantly differentiated between exercisers and non-exercisers while adjusting for other variables; only variables that significantly ($p < .05$) discriminated between the exercising and non-exercising group, were entered into the regression model. To take account of multiple testing, the Bonferroni criterion (the normal *p*-value divided by the number of tests) was used to interpret findings in case of significance.

RESULTS

General characteristics of the participants

Table 1 shows the characteristics of the exercising and non-exercising participants. The groups did not significantly differ with respect to education level, age or BMI, but there was a significant difference with respect to gender: the percentage of women in the exercise group exceeded the percentage of women in the non-exercise group (p = .006). Fathers of research participants in the non-exercise group were reported by the participants to be more overweight (p = .04), whereas the prevalence and severity of overweight mothers was not different. We did not find differences in dieting history with respect to occurrence of dieting attempts, mean duration of attempts, occurrence of weight cycling, current sportive activities, or physical exercise in daily life. The sportive activities most often mentioned, both in the physical exercise group and the non- exercising participants, were leisure (unorganised) walking, cycling, and swimming activities. There was no difference in time of onset of overweight between the groups: in approximately 40% of both groups overweight had started in childhood or adolescence.

Table 1. General characteristics of 58 exercise starting and 58 non-exercising participants

	Exercise group	Non-exercise group	$X^2/U/t$	p
Gender (female)[a], n (%)	46 (79%)	32 (55%)	7.61	.006
Education level[b], n (%)			1371	.08
Primary	8 (14%)	6 (10%)		
Secondary	33 (57%)	26 (45%)		
Tertiary	17 (29%)	26 (45%)		
Age[c]: mean (SD) years	44 (11)	42 (11)	1.17	.24
BMI[c]: mean (SD) kg/m²	34.6 (7.0)	32.8 (5.8)	1.51	.13
Onset overweight[b]			1675	.97
0-6 years	6 (10%)	5 (8%)		
6-11 years	7 (12%)	8 (14%)		
11-18 years	11 (19%)	11 (19%)		
> 18 years	34 (59%)	34 (59%)		

Overweight father[b], n (%)			1309	.04
None	23 (40%)	17 (29%)		
Some	21 (36%)	17 (29%)		
Substantial, less than mine	5 (9%)	7 (12%)		
Substantial, comparable to mine	6 (10%)	10 (17%)		
Substantial, more than mine	0 (0%)	5 (9%)		
Unknown	3 (5%)	2 (4%)		
Overweight mother[b], n (%)			1644	.96
None	15 (26%)	16 (28%)		
Some	17 (29%)	16 (28%)		
Substantial, less than mine	10 (17%)	7 (12%)		
Substantial, comparable to mine	6 (10%)	11 (19%)		
Substantial, more than mine	9 (16%)	5 (8%)		
Unknown	1 (2%)	3 (5%)		
Dietary history				
Dietary attempts in past[a]			2.18	.14
Yes	51 (88%)	45 (78%)		
No	7 (12%)	13 (22%)		
Duration attempt in weeks[c] (mean, SD)	14.0 (13.7)	16.4 (19.3)	-0.66	.51
Weight cycling[a]			2.49	.29
Yes	32	22		
No	19	21		
Other physical activities				
Involvement in sportive activities[a]			1.18	.18
Yes	27 (47%)	18 (31%)		
No	31 (53%)	40 (69%)		
Time spent weekly on sportive activities[b]			241	.95
< 1 hour/week	6 (22%)	3 (17%)		
1-2 hours/week	12 (44%)	10 (55%)		
2-3 hours/week	5 (19%)	3 (17%)		
3-4 hours/week	4 (15%)	2 (11%)		
Time spent on daily walking and cycling[b]			1518	.35
< 5 minutes	14 (24%)	14 (24%)		
5-15 minutes	17 (29%)	10 (17%)		
15-30 minutes	11 (19%)	8 (14%)		
30-45 minutes	7 (12%)	20 (35%)		
> 45 minutes	9 (16%)	6 (10%)		

[a]X^2 test. [b]Mann-Whitney *U* test.
[c]Independent *t*-test.

Main results

Table 2 shows the means of the exercising and non-exercising participants with respect to suffering and perceived medical problem, physical exercise beliefs, somatic complaints, quality of life and obesity cognitions.

The difference between both groups for the variables on suffering and perceived severity (PRISM-R2) was not significant.

Exercisers reported less fear of injury than non-exercisers ($p < .001$) and anticipated more health benefits as a result of physical exercise ($p = .03$). The two groups did not differ with respect to embarrassment and exercise confidence.

The amount and nature of somatic complaints not needing medical attention did not differ between both groups. The main problems in order of frequency were: fatigue (more than two-thirds in both groups), joint problems and back problems (over fifty percent) and shortness of breath (almost half of all participants).

The total quality of life score was not significantly lower in the group of exercisers ($p = .057$). Self esteem was significantly lower in the exercise group ($p = .046$). Group differences on the other quality of life dimensions failed to reach significance.

The groups differed significantly on three of the four obesity cognitions. As compared to the non-exercisers, the exercisers had lower scores on timeline ($p < .001$) and somatic cause ($p = .01$) and higher scores on behavioural cause ($p = .049$), which indicated that they were more optimistic about the changeability and the controllability of their overweight problem.

After application of the Bonferroni criterion for multiple testing ($p = .001$), fear of injury and timeline were still discriminating between exercisers and non exercisers.

Variables that were significantly different between the exercising group and the non-exercising group were entered into a logistic regression model. These variables were: gender, overweight father, fear of injury, exercise benefits, and the obesity cognitions timeline and physical cause. The results are presented in table 3. While controlling for other variables in the model, male gender (OR 5.30, 95% CI 1.97-14.25) and fear of injury remained significant predictors of belonging to the non-exercise group (OR 1.20, CI 1.05 – 1.36). The examination of possible interaction effects between each relevant psychological predictor and overweight of the father revealed no significant interactions.

Table 2. Means and medians of exercising and non-exercising overweight participants with respect to suffering, physical exercise beliefs, complaints, quality of life, and obesity cognitions

	Exercise group	Non-exercise group	U/t	p^a	Cohen's d^b
Perceived medical problem and suffering (PRISM-R2)					
Illness Perception Measure (IPM): mean (SD), range 1-3	1.9 (0.8)	1.6 (0.8)	1.95	.05	0.37
Self-Illness Separation (SIS): mean (SD), mm	26 (25)	33 (22)	-1.71	.09	0.32
Physical exercise belief (PEBQ)					
Fear of injury: mean (SD)	7.3 (3.6)	10.3 (4.1)	-4.21	<.001	0.77
Embarrassment: mean (SD)	10.2 (5.7)	9.5 (5.1)	0.73	.47	0.14
Exercise benefits: median (IR)	18.1 (2.0)	17.1 (2.4)	2.26	.03	0.42
Confidence: mean (SD)	8.7 (3.1)	8.2 (3.3)	0.90	.37	0.17
Somatic complaints: median (IR), range 11-55	14 (6)	14 (3)	1316	.18	
Quality of life (IWQOL-Lite)					
Physical function: mean (SD)	69.0 (20.0)	74.8 (18.6)	-1.68	.10	0.32
Self esteem: mean (SD)	64.0 (27.7)	74.3 (27.2)	-2.01	.05	0.37
Sexual life: median (IR)	81.3 (34.4)	100.0 (18.8)	1319	.09	
Public distress: median (IR)	92.5 (30.0)	95.0 (20.0)	1543	.42	
Work: median (IR)	93.8 (18.8)	100.0 (9.4)	1381	.13	
Total: mean (SD)	74.2 (15.9)	84.7 (22.6)	1133	.06	0.37
Obesity cognitions (OCQ)					
Time-line: mean (SD)	15.1 (3.7)	17.9 (4.2)	- 3.80	<.001	0.71
Physical cause: mean (SD)	10.0 (3.0)	11.7 (3.9)	- 2.54	.01	0.50
Behavioural cause: mean (SD)	20.4 (3.1)	19.1 (4.1)	1.99	.05	0.39
Psychological consequences: mean (SD)	26.1 (6.2)	23.9 (8.2)	1.69	.12	0.32

As measures of central tendency (M) and spread, for somatic complaints, the IWQOL-Lite scales sexual life, work, and public distress, medians and interquartile ranges (IR) are presented. For all other variables means and standard deviations (SD) are presented. Better functioning is represented by higher values at the IWQOL-Lite, and PEBQ exercise benefits and confidence, OCQ behavioural cause, and PRISM-R2 distance (SIS). Better functioning is represented by lower scores at PEBQ fear of injury and embarrassment, OCQ physical cause and time-line, and PRISM-R2 subjective illness severity (IPM);

[a]*p*- values were calculated with Mann-Whitney *U*- tests (*U*) for skewed variables and *t*- tests (*t*) for normally distributed variables.

[b]Cohen's *d* was calculated in normally distributed variables.

Table 3. Predictors of membership of the non-exercising group

Variable	B	SE	*p*	OR
Gender	1.67	0.51	.01	5.30
Overweight father	0.29	0.17	.10	1.33
Exercise benefits (PEBQ)	-0.16	0.12	.17	0.85
Fear of injury (PEBQ)	0.18	0.07	.007	1.20
Timeline (OCQ)	0.13	0.07	.06	1.14
Physical cause (OCQ)	0.08	0.08	.28	1.09

PEBQ: Physical Exercise Belief Questionnaire.
OCQ: Obesity Cognition Questionnaire.
OR : Odds Ratio.

DISCUSSION

Health beliefs of overweight adults who did and did not participate in a physical exercise programme were compared with the aim to identify possible factors that hamper people to start physical exercise. Account was taken of socio-demographic factors. Fear of injury was higher and perceived health benefits were lower in the non-exercisers, who also more often attributed their overweight to physical causes and believed overweight to be irreversible. The burden of suffering, somatic complaints, and quality of life of the groups were not significantly different. Exercisers, as compared to non-exercisers, were more often female and had fathers with less overweight. Body weight, age, and education level of the groups were comparable. Fear of injury remained a significant predictor of belonging to the non-exercise group after controlling for other variables and multiple testing.

General characteristics

Of the demographic variables, female gender predicted exercise group membership. This observation is concordant with previous observations: women tend to utilise health care services more extensively[48], obese treatment populations include far more women than men[30], women tend to have a stronger belief in the benefits of healthy eating[49], and women are more motivated to a healthy lifestyle, including being physically active[50]. Our finding and these previous findings stress that a great challenge in health education, including promotion of physical activity, is to try to set

overweight men in motion.

Overweight of fathers but not of mothers was observed to be more prevalent and severe in the non-exercising group. Perhaps the fathers of this generation were more than the mothers concerned with encouraging their children in physical activities, especially the less obese fathers. Further research is needed to corroborate this finding.

Health belief model: threat

The 'threat' component of the health belief model, measured as perceived severity of the overweight, was not significantly higher in the exercise group. In our study, the exclusion of research participants with serious health problems may have prevented a significant finding. Probably the absence of a health threat perception until co-morbidities occur, may partly explain why overweight people do not start increasing their physical activities to improve their health.

Health belief model: barriers

We examined embarrassment and fear for injury as potential 'barriers' for physical exercise. Among female undergraduates, weight stigma experiences were related to physical exercise avoidance[51], but the embarrassment of adults in our research population did not differentiate between exercisers and non-exercisers and thus could not be considered a major barrier. A main finding of our study is that non-exercisers reported substantially more fear of injury. The role of fear and its consequences for exercise performance has been extensively examined in patients with chronic pain and is explained by the fear-avoidance model[52]. The model explicates that, if pain is (mis)interpreted as being threatening, avoidance of physical activity will result and this will subsequently have a negative impact on musculoskeletal function, physical performance and fitness[53]. In morbidly obese patients after bariatric surgery, fear of injury was a predictor of reduced physical exercise[22]. Our study suggests that, similar as in chronic pain patients and morbidly obese patients, fear of injury might be a major barrier of engaging in physical activity and contributes to the sedentary state of overweight individuals. As has been suggested[26, 54, 55], graded exercise programmes and education about fear avoidance will likely increase the engagement in physical activity and improve the treatment results in overweight persons.

Health belief model: benefits

'Benefits' in the health belief model refer to the believed effectiveness of strategies to reduce the threat[17]. Positive cognitions about one's capability to perform physical activity will increase the chance of getting engaged in physical exercise. In our study, confidence in perceived sportive abilities did not differ between groups, but persons who did not make the move to start organised physical exercise were less convinced that exercise would contribute to a better health. Logistic regression analysis suggested that the negative motivation to not exercise (fear for injury) is a more distinctive feature between exercisers and non-exercisers than the positive motivation of future health benefits.

Health belief model: cues to action

A primary motivation (cue) for obese individuals to decide to participate in weight loss treatment in medical centres is health impairment[19, 56]. In the present study, most participants confirmed that a main reason for starting physical exercise now or in future was or would be actual or possible health risks, but the exercise and non-exercise group did not differ in this respect. In addition, in contrast to expectation[32], actual health problems did not differ between the two groups, likely due to the exclusion of participants who where under medical supervision. A low quality of life and more suffering were hypothesised to be additional cues for the decision to participate in a physical exercise programme, as was observed for patients seeking treatment for obesity[32, 33]. However, our data did not support this hypothesis. Also BMI, another possible cue, did not differentiate between the groups. Overall, our data do not clearly support the notion that physical health problems or quality of life might differentiate between overweight people who do and do not decide to start physical exercise. These factors may stimulate the initiation of health behaviour only when the weight and health problems are extensive and quality of life is more severely disturbed than in the participants of the current study[30, 33]. When the high prevalence of overweight and moderate obesity in current society[2] is partly due to its relatively low interference with health and quality of life[57], preventive measures should use the threat of future consequences instead of current consequences as cues to stimulate physical exercise.

Self-regulatory model: obesity cognitions

Several other beliefs about overweight and self-regulatory capacities were hypothesised to differentiate between overweight persons who did and did not participate in physical training groups: the label of the threat, its timeline, the believed causes (somatic or behavioural) and consequences[18]. In our study the non-exercisers considered their overweight to be a more stable characteristic with a less positive prognosis; they tended to attribute their overweight to a physical cause and considered themselves unable to control their overweight problem. These results suggest the importance of addressing these cognitions in education and treatment programmes for overweight, including physical exercise programmes.

Limitations

There are several limitations to our study. First, the weight and height data were based on self-report, not on direct measurements. However, measured and self-reported weight are highly correlated, even up to r = .98[22, 58]. A second limitation of our study is that the participants of the two groups were differently selected. Participants in the exercise group were personally asked by their fitness instructor to participate, whereas the control group was recruited in several manners. Those participants who were recruited by way of advertisements and the Dutch Obesity Society (n = 16) were not asked personally and therefore might form a distinct group. It is not clear whether the overrepresentation of women in the exercise group is a consequence of selection bias or a true difference. An indication that the gender difference is based on a true difference, is the empirical observation that women are more motivated to participate in healthy behaviour such as exercise, and that obese women far more often enter treatment programmes[30, 50]. A third limitation of the study is that its exploratory character aimed at finding possible variables that play a role in the sedentary behaviour, bears the risk of overestimating differences between the two groups due to multiple testing. However, the differences in fear of injury and timeline were also significant after Bonferroni correction. Moreover, as a result of the small sample size of the study, the risk of type I error findings is relatively small.

Recommendation

A strong feature of our study is that the outcome variable differentiated between groups that actually did and did not attend a physical exercise programme instead of differentiating between self-reported physical exercise or intention to exercise. Future studies employing a prospective design could further analyse causative relations, by offering physical exercise activities to overweight persons of the same population (e.g. a primary health care population), and evaluate who do and do not accept the offer. Moreover, besides exercise programmes in fitness centres, prospective studies could include health promotion activities aimed at life style changes.

Conclusion

Over and above by being more often male, overweight people not entering an exercise programme differed from people who did enter an exercise programme with respect to health beliefs, most clearly fear of injury. Research is needed to examine whether the inflow of overweight people in exercise groups increases when health beliefs are recognised, considered, and discussed, both in individual contacts and public health campaigns promoting physical exercise in sedentary, overweight people.

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7

Chapter 7

Suffering and quality of life predict dropout from physical exercise programmes in obese adults

Adaptation of: Wouters EJ, Geenen R, Vingerhoets AJ. Lijdensdruk en kwaliteit van leven voorspellen uitval bij fysieke trainingsprogramma's voor volwassenen met obesitas**.** Psychologie en gezondheid 2009;37:267-275.

ABSTRACT

Obesity and lack of physical activity are risk factors for a wide variety of health problems. Dropout from physical activity interventions in overweight adults is considerable. Suffering and a poor quality of life have been demonstrated to be a cue to initiate exercise interventions. Our aim was to evaluate these variables as predictors of exercise compliance. Of 44 obese adults who participated in two physical exercise programmes, 21 (47%) completed the programme. Suffering was assessed with the Pictorial Representation of Illness and Self Measure, second revised version (PRISM-R2) and quality of life with the Impact of Weight on Quality of Life-Lite (IWQOL-Lite) questionnaire. As compared to non-completers, completers were older and reported less suffering and a higher quality of life. Our study suggests that intake assessments of suffering and quality of life can be helpful to identify participants who need extra counselling.

INTRODUCTION

Obesity is an important risk factor for the development of a number of diseases, e.g., type II diabetes, several types of cancer and cardiovascular disease[1]. In addition, lack of physical activity is an independent risk factor for these health problems[2, 3]. In wealthy countries the daily physical activity of most adults is below the recommended minimum[2, 4], which is even more striking in overweight persons[5]. Physical activity programmes have proven to be effective in weight loss and more importantly, in the maintenance of weight loss in intervention progammes[6-8], but the high dropout rate of participants is a problem[9].

Therefore, it is important to gain more insight into the factors that influence this dropout. Besides programme characteristics and environmental factors, also person factors can be relevant[10]. Factors such as self-efficacy, outcome expectations and dietary history have been found to be more or less predictive for therapy outcome and dropout rate[11-13].

Quality of life is considered an important outcome measure of physical exercise programmes. In several diseases, varying from renal insufficiency and cancer to cardiac disease and obesity, quality of life improved as a result of physical activity interventions[14-20]. Interestingly, in addition to being an outcome measure, quality of life can also be a predictor of health behaviour. According to the 'health belief model' a perceived health threat or cue can motivate people to adopt healthier life-styles[21]. This theory thus predicts that poorer health related quality of life can motivate the start and continuation of exercise behaviour.

On the other hand, poor quality of life can undermine the will power needed to sustain healthy behaviour. Moreover, obese persons often experience sportive activities as less pleasant compared to normal weight persons[22] and probably this holds even to a larger extent for people who experience low quality of life. There is some support for the hypothesis that better quality of life can motivate people to sustain healthy behaviour. In a behaviour therapy programme to improve lifestyle in obese persons, weight loss and compliance were more favourable in persons with a better quality of life[11, 12]. Also in prostate cancer patients participating in a physical training programme, compliance and quality of life were positively related[23].

Not only general quality of life, but also the extent to which one suffers from a health problem, may influence compliance to a physical exercise programme. Quality of life and suffering are related, but not identical constructs. Quality of life refers to general health, well-being and functioning. Suffering also refers to the extent to which the specific disease has caused loss of control over life. The impossibility to attribute meaning to the disease, enhances the perception of suffering[24].

Two measurable aspects of suffering are Self-Illness-Separation and Illness Perception Measure[25]. Self-Illness Separation refers to the extent to which a disease intrudes someone's life, whereas Illness-Perception Measure represents the personal perception of the magnitude of one's health problem.

There is currently a growing trend that fitness institutes aim at people with a health problem, like obesity or overweight. Gaining insight into the factors that predict dropout, in order to lower the risk of attrition, is particularly valuable for these settings. This knowledge makes it possible to offer additional support to participants with a high risk of dropout, and to offer tailor-made programmes, e.g., a multi-disciplinary programme also considering suffering and motivational and environmental factors, that can interfere with compliance to the programme.

The aim of this study was to gain knowledge on the predictive value of obesity-related quality of life and suffering of obese persons starting a physical training programme. We hypothesised that more suffering and poorer quality of life, would predict risk of dropout.

METHOD

Participants and procedure

This study is part of a study on the effectiveness of physical exercise programmes for obesity. Inclusion criteria were: Body Mass Index (BMI) of more than 30 kg/m², age between 18 en 65 years, no medical supervision for co-morbidities. Potential participants were informed by telephone about the programme, the inclusion criteria and the purpose of the study. After this, all participants received an information letter by post. A total of 44 persons were willing to participate and fulfilled the inclusion criteria. One week before the start of the training programme all participants were orally informed in detail about the programme and the study. After this information session, participants received an informed consent form and a questionnaire, to be filled out at home. In case of dropout from the programme an exit interview was held, in which the reason for discontinuation was asked. This study received the approval of the Ethical Board of Tilburg University.

Training

Training sessions were held two times a week during six months. Each session lasted an hour. Participants entered a programme of their own choice, being either a fitness programme (n = 18),

or an aquajogging programme (*n*= 26). Both programmes were specially designed for the purpose of the study and supervised by physiotherapists.

Measurements

Compliance

Compliance was defined as staying in the programme during the full six months, with a maximum of 20% missed training sessions.

Anthropometric and demographic variables

Weight was measured with the Tanita (tbf 300 m) balance, a bio-electrical impedance method for measurement of weight and body composition[26]. Length was measured with a tape measure fixed to the wall. BMI was calculated by dividing weight in kilograms by the square height in metres. Education level was determined in three levels: low (primary school only), middle (pre-vocational or secondary school) and high (higher professional or university).

Physical activity in daily life

Because it was expected that a better physical condition at baseline could influence compliance, two questions about (1) daily physical activity and (2) other sports activities, were posed. These questions were derived from the Baecke questionnaire for physical activity[27, 28]. The first question assessed how much time (minutes) participants spent on daily activities like cycling and walking to work, schools and shops, varying from less than five to over 45 minutes per day on a five point scale. The second question addressed other sports activities besides the training programme, and the time weekly spent on these activities, varying from less than one hour per week to more than five hours per week on a five point scale.

Suffering

Suffering was measured with the PRISM-R2 (Pictorial Representation of Illness and Self Measure, second revised version, see figure 1)[25]. The instrument consists of a firm sheet of white (A4 format) paper, with a yellow disk bearing the text 'self'. This disk is placed in the centre of a larger disk, with the text 'my life environment'. Each participant also receives a red sheet with three differently sized adhesive disks, representing one's medical problem. To participants it was explained that the red adhesive disks in this case referred to their overweight. One of the three disks is smaller, one is as big as, and one is larger than the yellow 'self' disk. The disk chosen is regarded as the

Illness Perception Measure (IPM): the larger the disk, the larger the perceived magnitude of the health problem. The distance between the centre of the yellow disk and the red disk, the Self-Illness Separation (SIS), is regarded as a measure of suffering. The score can vary between 0 to 93 mm. The PRISM-R2 is a valid instrument, applicable to a wide range of health problems such as obesity, to measure the extent of suffering from a health problem[25].

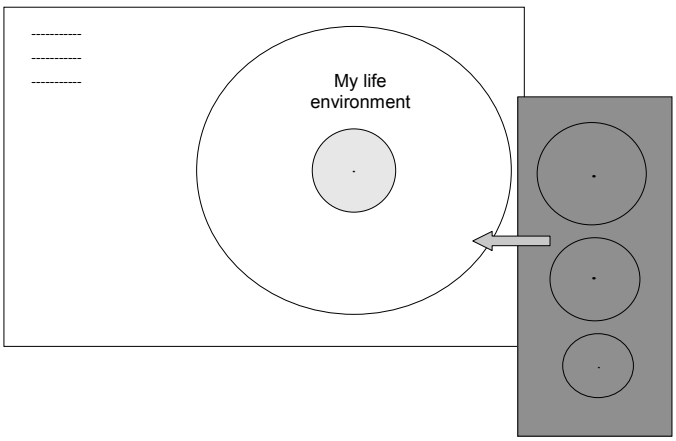

Figure 1. PRISM-R task. The respondent places one of the three red 'my medical problem' disks (right) in a self-chosen spot somewhere in the 'my life environment' circle.

Quality of life

Obesity-specific quality of life was assessed with the Impact of Weight on Quality of Life, short version (IWQOL-Lite)[29, 30]. The IWQOL-Lite questionnaire consists of 31 statements distributed over five domains: physical function, self-esteem, sexual life, public distress and work. A total score, varying from 0 to 100, can be calculated. A score of 100 represents the best possible quality of life. An improvement between 7.7 – 12 or more, dependent of the original score, is regarded as clinically significant[31]. Internal consistency and test-retest reliability are good[32], and the instrument responds to weight changes and can discriminate between overweight subgroups[33, 34]. The IWQOL-Lite specifically measures weight-related quality of life, in contrast to generic instruments, such as the Short Form-36[30].

Statistical analyses

Chi-square test was used for differences between nominal variables of compliant and non-compliant participants. Because of the small sample, both ordinal and scale variables were tested with the Mann-Whitney U test. Variables significantly discriminating between compliant and non-compliant participants were tested in logistic regression analysis. Collinearity was examined by calculating correlation coefficients between all variables entered in the logistic regression analysis. Absolute changes in scale scores of the IWQOL-Lite were regarded as effect sizes. A cut-off value for the PRISM-R2 was determined. *P*-values < .05 were considered statistically significant. All statistical analyses were performed using SPSS version 16.

RESULTS

Demographic variables and daily physical activity

After three months 30 (68%) of the participants were still active in the programme, and after six months this number was reduced to 21 (47%). There was no difference in dropout rate after six months between participants of the fitness group compared to participants of the aquajogging group. Most important reason mentioned for dropout, as evaluated in the exit interviews, was lack of time because of job demands and health complaints, not related to the exercise programmes. Differences in demographic characteristics between non-compliant (n = 23) and compliant (n = 21) participants are shown in table 1. Age was the only variable significantly related to dropout. Compliant participants in general were older than non-compliant participants (p = .01).

Table 1. Demographic characteristics of compliant and non-compliant participants in a six months physical exercise programme

	Non-compliant	Compliant	*p*
BMI, mean (range)	36.4 (30.3-50.9)	37.5 (30.7-53.1)	.55
Gender (% female)	83%	95%	.19
Education level			.29
low	8.7%	14.3%	
middle	39.1%	61.9%	
high	52.1%	23.8%	
Age, mean (range)	40 (31-53)	48 (25-64)	.01

Daily physical activity additional to the intervention programme is shown in table 2. In general, compliers were slightly more physically active in daily life compared to non-compliers, but the differences were not significant. In short, compliant and non-compliant groups were comparable, except for age.

Table 2. Daily physical activity besides the training programme in compliant and non-compliant participants

	Non-compliant	Compliant	*p*
30 minutes or more of walking or cycling per day, percentages	22%	38%	.15
Practice of other sports, percentages	35%	33%	.69
Number of hours of sports per week, mean (SD)	2.57 (0.79)	2.33 (0.82)	.38

Suffering and quality of life

Table 3 shows the differences for suffering and quality of life in compliers and non-compliers. Compliers and non-compliers show a significant difference in the distance in millimetres between the centre of the yellow self-disk and the centre of the red 'my medical problem' (the SIS) (table 3). The smaller distance in non-compliers represents more suffering. The size of the red disk (perceived magnitude of the health problem, IPM) was not significantly different between the two groups.

All IWQOL-Lite scales showed lower quality of life scores in the non-compliant group, for the 'work' and total scale score these differences were statistically significant. Moreover, the differences were clinically relevant, that is they all were > 7.7 [31].

Table 3. Suffering and quality of life in compliant and non-compliant participants: mean (SD)

	Non-compliant	Compliant	*p*
Suffering (PRISM-R)			
Self-Illness-Separation (SIS)	25 (21)	41 (25)	.03
Illness Perception Measure (IPM)	2.09 (0.90)	1.67 (0.73)	.11
Quality of life (IWQOL-Lite)			
Physical function	66 (18)	73 (18)	.26
Self-esteem	57 (27)	70 (22)	.11
Sexual life	77 (22)	88 (16)	.08
Public distress	77 (18)	86 (15)	.11
Work	84 (20)	93 (12)	.04
Total score	69 (14)	79 (12)	.04

Note:
PRISM-R2: Pictorial Representation of Illness and Self Measure, second revised version.
SIS: Self-Illness Separation. Lower scores represent more suffering.
IPM: Illness Perception Measure. Higher scores represent higher perceived magnitude of the health problem.
IWQOL-Lite: Impact of Weight on Quality Of Life, short version. Higher scores indicate better quality of life.

Variables significantly discriminating between compliers and non-compliers were entered as predictors in a logistic regression model (table 4). IWQOL-Lite total scores and PRISM-R2 SIS were not associated (r = .05, p = .75). Also no interaction was found between age and the other independent variables in the model. After correction for age, non-compliance was still significantly predicted by high suffering from obesity. Age and total quality of life score no longer predicted compliance, but the p-values were still smaller than .10.

Table 4. Results from logistic regression analysis, in which non-compliance is predicted by age, suffering and quality of life

Variable	OR	Wald	*p*
Age	0.93	3.41	.07
Suffering (PRISM-R2 SIS)	0.97	4.18	**.04**
Quality of life (total score IWQOL-Lite)	0.95	2.97	.09

Note:
PRISM-R2: Pictorial Representation of Illness and Self Measure, second revised version.
SIS: Self-Illness Separation. Lower scores represent more suffering.
IWQOL-Lite: Impact of Weight on Quality Of Life, short version. Higher scores indicate better quality of life.
OR: Odds Ratio; Wald-statistic is used to test significant associations between predictor variables and outcome variable.

For a preliminary impression if screening based on suffering (SIS) can help to indentify persons who are likely to dropout of the training programme, a cut-off point of 31 mm was set, based on frequency distribution (table 5). Sensitivity and specificity, indicating the predictive properties of a diagnostic instrument[35], were respectively 57% and 71%. Sensitivity of the SIS was 13/(13+10): based on the SIS score 57% of participants is correctly classified as 'non-complier'. Specificity is 15/(15+6): based on the test 71% of the participants is correctly classified as 'complier'.

Table 5. Accuracy in predicting compliance or non-compliance based on the PRISM-R2 SIS, with a cut-off value at or above 31

	Non-compliers	Compliers	
High suffering (SIS < 31)	13	6	19
Low suffering (SIS >= 31)	10	15	25
	23	21	44

Note: SIS: Self-Illness Separation.

DISCUSSION

The main aim of this study was to evaluate predictors of dropout in physical exercise programmes. It appeared that dropout could be predicted from young age, and high perceived suffering and low quality of life as a result of obesity.

Because treatment can improve the condition of obese persons[33], it is plausible that low quality of life and high suffering will motivate obese persons to participate in an intervention programme. This might have been the main motivation for our study group. The changeable parts of quality of life and suffering can be regarded as a state, rather than as a trait. If quality of life at a certain moment in life is relatively low, this might be a cue to *start* an intervention[36]. Our study shows that *compliance* to an intervention however is predicted by relatively low suffering and high quality of life. Possibly this is explained by the more stable aspects of low quality of life being related to neuroticism, lack of self-efficacy or ineffective coping[37, 38]. More research is needed to test if in particular the more stable characteristics of participants are decisive for dropout in physical exercise programmes.

Our dropout rate (about 50%) is comparable to dropout rates in previous obesity intervention studies[39, 40]. Participants were coached by regular fitness instructors without additional support from other disciplines. This is a realistic situation, comparable to the common procedure in fitness centres where persons start a programme with minimal supervision. Ultimate purpose of every

physical exercise programme is to promote enhanced physical activity in daily life. Lifestyle intervention programmes, in which physical exercise is an integral part of activities of daily life, appear to have lower dropout rates if properly supervised[41]. In order to comply to exercise programmes, it is important that the participants experience these physical activities as something enjoyable and positive[42]. When maladaptive cognitions, e.g., fear of injury, are barriers for physical activity, cognitive behavioural interventions or coaching based on motivation, can reduce the dropout rates[6, 43]. We did not study supplemental support aimed at the integration of physical activity into daily life, choice of pleasant forms of physical activity and attention for maladaptive cognitions. One may expect that such an additional support is important for persons who perceive high suffering and low quality of life.

Most of the demographic variables did not differ between compliant and non-compliant participants. This also applied to the daily physical activity besides the exercise programme. Our non-compliers were relatively young though, which is concordant with other studies in which compliers also often were the older participants[44]. A frequently heard reason for dropout in relatively young people is lack of time, e.g., due to work or family obligations[40, 44]. In our study also lack of time was mentioned as most important reason for non-compliance. Programmes offered in favourable periods of the day and in cooperation with employers, might be more successful for adults having a fulltime job.

To measure suffering we used the PRISM-R2, a practical and easy to apply instrument. This instrument can measure in a fast and simple way two aspects of suffering. Self-Illness-Separation (SIS) was more predictive than Illness Perception Measure (IPM). Within the PRISM-R2 the SIS represents the more intuitive severity of suffering, and the IPM the more rational estimation of the magnitude of the health problem and possible future health risks[25]. Future research will provide evidence if IPM is more important as a predictor to start a physical exercise programme. The sensitivity and specificity we assessed for the SIS is comparable to the values found for short questionnaires as used for screening on depression[45]. If our results can be confirmed in a larger sample and if clear cut-off points can be established, PRISM-R2 could be a screening method for potential participants of an obesity exercise group who need additional support.

Limitation of this study is the small sample size of the groups. The number of compliers and non-compliers was sufficiently large to find large differences between the groups, but it lacked power to establish moderate or small effects[46]. Another limitation is that we exclusively studied physical exercise programmes. It is possible that results are therefore not generalisable to other, for example, multi-disciplinary interventions. Because there is a growing consciousness that physical activity is healthy, many people start an exercise programme themselves or are referred by their

general practitioner. Therefore it is helpful to have an indication of success of following such a programme and indentifying high risk participants in order to prevent them from dropping out.

Conclusion

Young age, high obesity-related suffering and low quality of life, predict dropout in physical exercise programmes. This knowledge can be useful to identify and further support participants with an enhanced dropout risk.

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8

Chapter 8

Effects of aquajogging in obese adults: a pilot study

Wouters EJ, van Nunen AM, Geenen R, Kolotkin RL, Vingerhoets AJ. Effects of aquajogging in obese people: a pilot study. Journal of Obesity. In press.

ABSTRACT

Aim and method: To examine in obese people the potential effectiveness of a six-week, two times weekly aquajogging programme on body composition, fitness, health-related quality of life and exercise beliefs. Fifteen otherwise healthy obese persons participated in a pilot study.

Results: Total fat mass and waist circumference decreased 1.4 kg (p = .03) and 3.1 cm (p = .005) respectively. The distance in the Six-Minute Walk Test increased 41 meters (p = .001). Three scales of the Impact of Weight on Quality of Life-Lite questionnaire improved: physical function (p = .008), self-esteem (p = .004), and public distress (p = .04). Increased perceived exercise benefits (p = .02) and decreased embarrassment (p = .03) were observed.

Conclusions: Aquajogging was associated with reduced body fat and waist circumference, and improved aerobic fitness and quality of life. These findings suggest the usefulness of conducting a randomised controlled trial with long-term outcome assessments.

INTRODUCTION

Of the more than 1 billion overweight adults, at least 300 million are obese (Body Mass Index [BMI] > 30 kg/m^2)[1, 2]. Obesity increases the risk of chronic diseases, particularly cardiovascular disease [3-5], type II diabetes mellitus[6, 7], and osteoarthritis [8, 9] in adults. Quality of life is severely reduced in obese persons[10, 11] and it is related to the degree of overweight[12]. Both obesity and living a sedentary life have been associated independently with decreased quality of life[13] and stress regulation[14].

Physical exercise combined with dietary adjustments, massages and baths, has been recommended for obesity since Hippocrates (fourth century BC)[15]. Aerobic exercise produces less weight loss compared to caloric restriction programmes[16]. Some recent studies, however, give evidence for weight loss, especially abdominal weight loss, as a result of exercise without caloric restriction[17-19]. Given the benefits for both physical and mental health[20], exercise has been widely recommended to reduce the health risks associated with overweight and obesity, even if the weight loss is minimal[19, 21, 22]. However, there is a substantial elevated risk of injuries in obese persons, especially sprains and strains[23].

Physical exercise in water is a possibility to try to increase physical and mental health of obese patients without the risk of injuries. Aerobic activities in water have been found to be effective to improve aerobic fitness[24], and the effect on body composition has been demonstrated to be similar to weight-bearing aerobic exercise on land[25]. Aquajogging is a specific form of exercise which consists of simulated running in deep water. In sports, aquajogging is used as low impact training, e.g., in the rehabilitation phase after an injury. Aquajogging has been applied as a joint sparing intervention in rheumatologic diseases such as osteoarthritis, in the pre- and postoperative management of musculoskeletal diseases, and as an endurance and power training in cardiorespiratory disease[26-28]. According to a search in the international reference system Web of Science, aquajogging as an intervention to improve physical and mental health in obese people has not been evaluated up till now.

The aim of this pilot study was to examine the safety and potential effectiveness of a six-week aquajogging exercise programme on body composition, aerobic fitness, and health- related quality of life and exercise beliefs in obese people.

MATERIALS AND METHODS

Participants

Participants were recruited with advertisements in a local paper, a poster in the waiting-room of local general practitioners and an appeal on the website of the Dutch Obesity Association. Inclusion criteria were a BMI of at least 30 kg/m², age between 18 and 65 years, and the intention to miss no more than two out of twelve training sessions. Exclusion criteria were an identified somatic disease and use of medications. The first 15 obese people who applied for the intervention and fulfilled the inclusion and exclusion criteria were invited to participate. The study was approved by the institutional review board of Reinier van Arkel group (mental health care department, 's Hertogenbosch) and all participants provided written informed consent.

Aquajogging programme

Participants enrolled in a standard aquajogging programme consisting of warming up, running in deep water alternated with extra arm and leg exercises, and cooling down, on stimulating music adapted to the phase of the programme[29]. Twelve sessions were given, two times per week during six weeks. Four physiotherapy graduate students alternatively carried out the programme. Each session lasted for one hour. Every participant could train at his or her own level, although they were stimulated by their trainer to gradually increase their effort throughout the session.

Anthropometry and body composition

Height was measured using a tape measure fixed to the wall with participants on bare feet. Body weight, fat mass, and fat percentages were measured with the Tanita tbf-300m[30, 31]. The Tanita, a bio-impedance analysis method to measure body composition, has proven to be valid in obese people[32], especially when monitoring modest changes in fat[33]. Waist circumference was measured with a special waist circumference tape measure using the iliac crest as a landmark. Measures were taken in duplicate and averaged.

Aerobic fitness

The Six-Minute Walk Test (6MWT) was performed outdoors in comfortable weather circumstances according to the procedure as described by the American Thoracic Society[34]. Participants were instructed to walk as much distance as possible without running in six minutes; encouragement was given as recommended[34]. The 6MWT is a valid and reproducible tool to measure aerobic fitness in a group of obese people[35]. Heart rate values during rest and immediately after the 6MWT were measured three times and averaged, using the MD300-D finger pulse oximeter (Medisane). After the 6MWT the modified Borg scale was applied to assess exertion. This measure consists of a visual analogue scale measurement ranging from 0 (no exertion) to 10 (extreme exertion)[36-38].

Health-related quality of life

Health-related quality of life was measured using the Dutch version of the IWQOL-Lite (short form of Impact of Weight on Quality of Life) questionnaire. The IWQOL-Lite is a 31 item, obesity-specific health-related quality of life questionnaire. It consists of five scales: physical function, self-esteem, sexual life, public distress, and work[39]. The IWQOL-Lite has been shown to have good internal consistency (Cronbach's α range from .90 to .96)[40], good test-retest reliability (correlations range from .83 to .94)[12], responsiveness to weight loss and weight gain[41, 42], sensitivity to treatment seeking status[12] and degree of obesity[43], and a scale structure supported by confirmatory factor analysis[40].

Exercise beliefs

Perceived barriers and benefits of physical exercise were measured with the Physical Exercise Belief Questionnaire (PEBQ)[44]. The PEBQ is partly derived from the Dutch version of the Tampa scale of Kinesiophobia[45] and consists of four scales. Two scales (fear of injury and embarrassment) measure exercise barriers (high scores indicate high perceived barriers) and two scales (exercise benefits and confidence) measure health benefits of exercise and exercise self confidence (high scores indicate high perceived benefits). The psychometric characteristics of the PEBQ have proved to be satisfactory in a sample of 278 obese and severely obese patients[44].
Self-efficacy was assessed with The Dutch version of the 18-item Exercise Self-Efficacy Scale[46].

Physical activity

Recent and current exercise behaviour was measured by asking 'do you engage in sportive activities?' (response alternatives: yes or no), an open ended question about the nature of these activities, and the time spent on these activities weekly during the past year, using a 5-point scale response format ranging from 'less than one hour per week' to 'more than four hours per week'. Walking and cycling activities during daily life like shopping, going to work or going to school, were rated on a five point scale, ranging from less than five minutes per day to more than 45 minutes per day.

Qualitative evaluation

A brief individual open interview with all participants after three and after six weeks of training evaluated the aquajogging programme and its effects on daily activities as well as experienced negative effects during and after training, such as injuries or muscular pain. All interviews were performed at the same time for all participants, after three and six weeks of training.

Statistical analysis

The mean change between the baseline assessment scores and the scores after the aquajogging programme were compared for BMI, fat percentage, fat mass and waist circumference, the distance covered in the 6MWT, and the heart rate during rest and immediately after the 6MWT, the Borg exertion rating, the scale scores on the IWQOL-Lite, the PEBQ, and the Exercise Self-Efficacy Scale. Considering the small sample size, the non-parametric Wilcoxon signed ranks test was used to examine the significance of the differences between baseline and at six weeks. All analyses were conducted using the programme Statistical Package for the Social Sciences (SPSS Version 14.0; SPSS Inc., Chicago, IL). Results are presented as mean (SD).

RESULTS

Descriptives

Fifteen otherwise healthy obese persons entered the programme. Anthropometric and demographic characteristics at baseline are presented in table 1. One (male) participant dropped out of the study a week before the end of the programme because of a respiratory infection. Thirteen of the participants were women with a mean age of 44 years, and a mean BMI of 38 kg/m². One woman used anti-depressive medication (Duloxetine), a serotonin and noradrenalin reuptake inhibitor not influencing body weight[47], 60 mg daily. The mean participants' self-reported daily physical activity, including sportive activities, was less than 30 minutes. No diets with the intention of extra weight loss were used during the programme.

Table 1. Anthropometric and demographic characteristics at baseline

Age, mean (range) years	44 (28-60)
Number of participants, male/female	2/13
Body weight, mean (SD) kg	105.6 (13.2)
Body Mass Index, mean (SD) kg/m²	37.9 (5.0)
Educational level, n (%)	
< 9 years of education	3 (20)
9-12 years of education, no high school degree	2 (13)
High school graduates	5 (33)
Bachelor or Master degree	5 (33)

Changes in body composition

Weight, BMI and fat percentage were lower after six weeks compared to baseline, but the differences were not statistically significant (table 2). Fat mass decreased in 11 and increased in 3 participants. The change of fat mass from 48.5 (10.5) to 47.1 (10.8) kg was significant ($p < .05$). Waist circumference decreased in 12 and increased in two participants (a statistically significant change, $p < .01$).

Changes in aerobic fitness

The distance walked in the 6MWT was significantly longer after six weeks of aquajogging; it changed from 574 (42) to 615 (37) meters ($p < .01$) (table 2); all participants showed an increase in walking distance. Both heart rate and perceived exertion after the 6MWT did not alter after 6 weeks of aquajogging.

Table 2. Effects of aquajogging on body composition and aerobic fitness of 14 participants, means (SD)

	Baseline	Six weeks	p^a
Body composition			
Weight (kg)	106.1 (13.7)	104.7 (14.1)	.06
BMI (kg/m²)	38.2 (5.0)	37.7 (5.1)	.06
Fat percentage (%)	45.5 (5.9)	44.7 (6.1)	.06
Fat mass (kg)	48.5 (10.5)	47.1 (10.8)	.03
Waist circumference (cm)	113.5 (10.4)	110.4 (10.4)	.005
Aerobic fitness			
HR rest (bpm)	85 (14)	82 (13)	.60
HR after 6MWT (bpm)	131 (19)	135 (21)	.18
Distance 6MWT (m)	574 (42)	615 (37)	.001
Borg exertion score	5.3 (1.6)	6.2 (1.8)	.11

[a]Wilcoxon signed ranks test.
BMI = Body Mass Index, HR = heart rate, 6MWT = 6 Minute Walk Test.

Changes in health-related quality of life

The scores on all scales of the IWQOL-Lite in the study group reflected a poor quality of life at baseline (table 3): the scores were on average 10 to 20% lower than the scores in the general population[10]. The scores on three scales of the IWQOL-Lite significantly improved after six weeks of aquajogging: physical function increased from 62.8 (24.2) to 70.2 (21.7), $p < .01$, self-esteem increased from 60.2 (26.5) to 70.2 (21.7), $p < .01$, and public distress increased from 78.2 (17.8) to 83.0 (14.3), $p < .05$.

Changes in exercise beliefs

The PEBQ showed a significant ($p < .05$) increase in perceived exercise benefits after six weeks of aquajogging (table 3). Eight out of 14 participants indicated increased perceived exercise benefits, one participant perceived decreased exercise benefits, and five showed no changes. Ten of 14 participants indicated decreased and three increased embarrassment, the mean change being statistically significant ($p < .05$). Fear of injury, confidence and exercise self-efficacy did not show any significant change after 6 weeks of aquajogging (table 3).

Table 3. Health-related quality of life and exercise beliefs of 14 participants: means (SD)

	Baseline	Six weeks	p[a]
IWQOL-Lite[b]			
Physical function	62.8 (24.2)	69.8 (18.5)	.008
Self-esteem	60.2 (26.5)	70.2 (21.7)	.004
Sexual life	84.8 (20.8)	88.8 (13.5)	.26
Public distress	78.2 (17.8)	83.0 (14.3)	.04
Work	90.2 (10.0)	91.3 (9.0)	.60
PEBQ[c]			
Fear of injury	9.9 (4.0)	9.6 (3.2)	.75
Embarrassment	12.6 (4.3)	10.4 (4.5)	.03
Confidence	8.7 (2.6)	9.1 (3.0)	.48
Exercise benefits	17.4 (1.8)	18.3 (2.0)	.02
Exercise Self-Efficacy	67.3 (16.6)	70.4 (16.8)	.28

[a]Wilcoxon signed ranks test.
[b]IWQOL-Lite: Impact of Weight on Quality Of Life – short form.
[c]PEBQ: Physical Exercise Belief Questionnaire.

Qualitative evaluation

Thirteen participants were very positive about aquajogging as a way of physical exercise. All participants perceived improved aerobic fitness in daily life and reported improved self confidence. Most participants reported decreased clothing size. Participants experienced decreased appetite and three spontaneously made an appointment with a dietician to start dietary treatment after the end of the aquajogging programme. Injuries or uncomfortable muscular pain were not experienced by any participant during or after the training. All participants valued the fact that they exercised in a group with the same obese condition.

DISCUSSION

After a 6-week aquajogging group programme without dietary restriction in obese people, improvements in body composition, aerobic fitness and quality of life were observed.

With respect to weight loss, our study is in agreement with previous findings that weight loss is limited after physical activity as mono therapy[16]. Some studies suggest that physical exercise may result in - at best - modest weight loss independent of the effect of caloric reduction through diet[17-19]. These studies employed strenuous physical exercise regimes equal to a daily energy expenditure of 500 kcal (women) or 700 kcal (men). Although we did not measure this variable, the reduction in energy expenditure is supposed to be low in our intervention, because the programme lasted for one hour regardless of caloric loss and was performed only twice a week. If the training programme had covered a longer period of time, with higher frequency and intensity, better results on weight would have been expected. On the other hand, although the relatively low intensity of aquajogging may make it less effective to lose weight, it is considered a suitable intervention for obese people, because they perceive it as a positive exercise experience, which has been reported as being important in previous studies focused on physical exercise with obese patients[48]. Physical activity has been recommended for obese persons because it increases cardiorespiratory fitness independent of caloric loss[49, 50]. Obese persons are more likely to have hypertension, dyslipidemia and the metabolic syndrome[51, 52]. Exercise training has been found to decrease heart rate at rest[53], but a substantial effect of aquajogging on resting heart rate was not found in our study, perhaps because the duration, frequency or intensity of the training was too low[54]. Obesity related comorbid conditions (especially insulin resistance) have been found to be reduced by increased daily physical activity without caloric restriction[18]. Our study observed a significant reduction of fat mass and waist circumference, a visceral fat measure that is a risk indicator for comorbidity[55, 56]. The results of our pilot intervention in obese people suggest that promising health effects can be expected from aquajogging, even when weight loss is minimal.

We used the 6MWT test as a measure of functional capacity[34]. The mean baseline walking distance observed in our obese participants was slightly lower than that reported in healthy adults[57]. The mean increase in walking distance of 41 meters is in between the effect of corticosteroid inhalation, and exercise and diaphragmatic strength training, in COPD patients[34]. This possibly clinically relevant change in distance should be interpreted with some caution. Perhaps the results are partly due to the learning effect of doing the test for the second time[35]. Our study did not find positive effects of aquajogging on exertion scores after the walking test. However, because baseline

exertion and post intervention exertion scores related to a different physical performance after the walking test on the two occasions, our study does not allow a final evaluation of effects of aquajogging on physical exertion. Perhaps increased confidence made the participants to exceed their limits in the walking test after the intervention.

After the aquajogging programme, the health-related quality of life scores of our participants showed an improvement in public distress and in the scales that normally deviate most from normal weight people: physical function and self-esteem[10, 12]. In addition, exercise embarrassment decreased and the perception of exercise benefits increased after the aquajogging programme, as indicated by the PEBQ findings and the open interviews. Our pilot study shows that quality of life improves and suggests that aquajogging might bring about these effects.

Aquatic exercise has been proved beneficial in other patients with conditions who are at risk when performing strenuous exercise like osteoarthritis[27, 58, 59], fibromyalgia[60], and sports injuries[28]. The severely obese people also belong to this group for whom aquatic exercise may be the physical exercise intervention of choice, because they are unable to perform large amounts of exercise over the short term[61] and there is a substantial risk of injury[23]. In our study, no participants experienced any injury suggesting that aquajogging might be a safe way of exercising in obesity.

There are limitations to the present study, including the small sample size, the predominance of women, the lack of a randomised, untreated control group, the relatively short duration of the intervention, and the absence of a follow up evaluation to examine persistence of effects. Future evaluations of aquajogging programmes should include muscular fitness, because higher resistance against the limbs' movement created by the water could improve both cardiorespiratory and muscular fitness. This was not tested in our study. Because it was considered of utmost importance that participants learned to like physical exercise, we did not stimulate high intensity exercise and did not repeatedly assess variables such as heart rate, Borg's perceived exertion scale, or training diaries. Our study did also not take into account possible concomitant dietary changes. As in many other studies, our study population consisted of participants who volunteered for the programme. This restricts the generalisability of the results to obese people who may be considered motivated to participate in this kind of intervention.

Conclusions

Physical exercise in water is a possibility to try to increase physical and mental health of obese persons without the risk of injuries. In a six-week open-trial in obese persons, aquajogging without caloric restrictions was associated with reductions in body fat and waist circumference, and

with improvement of aerobic fitness and quality of life. These findings suggest the usefulness of conducting a randomised controlled trial with long-term outcome assessments. The indication that aquajogging results in physical and mental health benefits for obese people, suggests that it might be a valuable therapy in itself or as an adjunct to a dietary intervention.

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Chapter 9

Physical activity after surgery for severe obesity: the role of exercise cognitions

Wouters EJ, Larsen JK, Zijlstra H, van Ramshorst B, Geenen R. Physical activity after surgery for severe obesity: the role of exercise cognitions. In preparation.

ABSTRACT

Background and aim: Physical activity after bariatric surgery is associated with sustained weight loss and improved quality of life. Some bariatric patients engage insufficiently in physical activity. The aim of the study was to examine whether and to what extent both physical activity and exercise cognitions have changed at 1 and 2 years post-surgery, and whether exercise cognitions predict physical activity.

Method: In 42 bariatric patients (38 women, 4 men; mean age 38 ± 8 years, mean BMI prior to surgery 47 ± 6 kg/m²), self-report instruments examined physical activity and exercise cognitions pre- and post surgery.

Results: Moderate to large healthy changes in physical activity and exercise cognitions were observed after surgery. Perceiving less exercise benefits and less confidence in exercising before surgery predicted less physical activity two years after surgery. Moreover, high fear of injury one year after surgery predicted less physical activity two years after surgery.

Conclusion: After bariatric surgery, favourable changes in physical activity and exercise cognitions are observed. Our results suggest that targeting exercise cognitions before and after surgery might be relevant to improve physical activity.

INTRODUCTION

People who are physically active have a better physical and mental health[1-6]. Various ways to promote physical activity have been examined[7-9], in particular among overweight individuals considering the weight benefits of increased activity[10, 11]. However, compliance with exercise interventions is a main problem[12], and after the intervention, exercise levels decline and individuals regain weight[13].

After bariatric surgery for severe obesity, healthy changes in physical activity have been reported, and individuals who are physically active after surgery lose more weight and experience better quality of life compared to those who stay inactive[14-16]. To date, it is neither clear what might be a suitable cognitive-behavioural approach to enhance physical activity in obese patients after surgery nor why some patients engage in sportive activities, while others stay sedentary[17]. Insight into variables that predict physical activity after surgery may contribute to tailoring cognitive-behavioural intervention programmes. Theories such as the self-regulatory model of illness stress the importance of cognitions as determinants of health behaviour[18, 19]. Cognitions about exercise have been found to correlate to actual exercise behaviour, both in general and in overweight populations[20-23], and a prospective study in adolescents revealed favourable changes in cognitions after a weight loss camp[24]. Cognitions about exercise can obstruct or promote physical activity. Physical activity may be hampered by beliefs that exercise has negative consequences such as the belief that one might get injured or ideas of shame about other people observing you while doing sports. Physical activity may be promoted by beliefs that exercising is beneficial for health or by being confident in sports participation.

Whereas the importance of physical exercise cognitions and the possible changeability of these cognitions as a result of interventions have been underscored, neither the impact of gastric banding on exercise cognitions nor the prediction of physical activity after surgery from exercise cognitions have been subject of study. The aim of the present study was to examine whether and to what extent exercise cognitions and physical activity change after bariatric surgery and whether exercise cognitions before surgery and one year after surgery predict physical activity two years after surgery. We hypothesised that exercise cognitions and physical activity change favourably after surgery and –for the exercise cognitions- that perceived benefits of exercise predict more physical activity and perceived barriers of physical exercise predict less physical activity.

METHODS

Participants and procedures

From November 2000 until April 2004, 156 patients were subjected to laparoscopic adjustable gastric banding (LAGB) at the St. Antonius Hospital Nieuwegein, the Netherlands, using the Lap-Band® system (INAMED Health, Santa Barbara, CA, USA), after screening by a team consisting of a bariatric surgeon, an endocrinologist, a psychologist and a dietician. Indication for surgery were Body Mass Index (BMI) > 40 kg/m² or a BMI between 35 and 40 kg/m² and serious co-morbidities. Surgery was performed according to the techniques described by Belachew et al[25]. Of these 156 patients, 140 patients agreed to participate in the study.

Weight and height were measured and questionnaires were filled out six months before and one and two years after surgery. To be able to compare the models examining the prediction from pre-surgery to two years after surgery and the prediction from one year after surgery to two years after surgery, it was decided to include only patients with complete data. Patients with missing values on any of the variables at one of the occasions (six months before, and one and two years after surgery) were excluded. Forty-two patients filled out the questions on physical activity and exercise cognitions completely at all time points.

The group consisted of 38 (90%) women and four men. Mean BMI before surgery was 47 ± 6 kg/m², mean BMI's one year and two years after surgery were 37 ± 7 and 36 ± 7 kg/m² respectively, and excess BMI loss[26] one year and two years after surgery was 46 ± 21% and 53 ± 25%. Mean age before surgery was 38 ± 8 years. The highest education level attained by patients was in one case primary education, in 36 secondary education, and in five cases tertiary education. Age, gender distribution, baseline BMI, and excess BMI loss between this group and the remainder of the 140 patients showed no differences. In addition, no differences were found between exercise cognitions and physical activity between the groups before surgery. The mean education level in the group with all measurements was higher than in the remainder of the group (p = .01). The study protocol received the approval of the hospital Research and Ethics Committee.

Measures

Weight and height were measured at the hospital with participants wearing light clothes and without shoes and socks. BMI was calculated as weight (kilograms) divided by the squared length (meters). Physical exercise was assessed with the Baecke questionnaire. This questionnaire yields a

validated and reliable sport index[27-29], which is a composite score taking into account the expected energy expenditure for a given sport, the number of hours per week and the number of months per year that one exercises, an estimation of the level of physical activity compared to other adults of the same age category as the participant, and the frequency of sweating during leisure time. All kinds of sportive leisure time activity, e.g., walking, swimming, cycling, dancing, are included.

Perceived benefits and barriers of physical exercise (exercise cognitions) were measured with the Physical Exercise Belief Questionnaire (PEBQ). This 16-item questionnaire, which is partly based on the Dutch version of the Tampa Scale for Kinesiophobia (TSK) consists of four scales[23]. Two scales assess barriers to physical exercise: 'fear of injury' (e.g., 'sports are dangerous for me because I easily get injured') and 'embarrassment' (e.g., 'I feel ashamed of my body when doing sports'). Two other scales measure perceived 'exercise benefits' (e.g., 'sports are healthy for me') and 'confidence' (e.g., 'I am a sporty type of person'). The 5-point Likert-rating format ranges from 1 (strongly disagree) to 5 (strongly agree). The psychometric characteristics of the PEBQ have been found to be satisfactory[23]. In the current study, Cronbach's α values six months before and one and two years after surgery were .90, .84 and .90 for fear of injury, .90, .84, and .91 for embarrassment, 0.67, .92, and .70 for exercise benefits, and .67, .81, and .85 for confidence.

Statistical analyses

The score distribution of all variables was sufficiently normal to allow parametric statistics. To examine differences in physical activity and exercise cognitions before surgery and one and two years after surgery respectively, paired-samples *t*- tests were used. Cohen's *d* effect sizes were computed by dividing the difference between mean scores at two time points by the pooled standard deviations. Effect sizes of 0.2, 0.5 an 0.8 are considered small, medium and large effect sizes, respectively[30]. To examine the stability of cognitions before and after surgery, Pearson correlations were calculated.

Physical activity change scores were calculated by adjusting the physical activity scores two years after the operation for baseline physical activity (physical activity six months before and one year after surgery, respectively). It was examined whether the person characteristics BMI, age, and education level were correlated with the outcome variable by computing Pearson correlations between these variables six months before surgery and one year after surgery on the one hand and physical activity two years after the operation and the postoperative change in physical activity on the other hand. To examine whether exercise cognitions before surgery and one year after surgery predicted physical activity two years after surgery, we computed Pearson correlations between

exercise cognitions six months before surgery and one year after surgery on the one hand and physical activity two years after the operation and the postoperative change in physical activity on the other hand. The alpha level for statistical significance was set at .05. For the paired samples *t*-test the Bonferroni criterion of .02 was used, to compensate for multiple testing (.05 divided by the number of three repeated measurements). All analyses were performed using SPSS 17.0 (SPSS Inc, Chicago Ill).

RESULTS

The postoperative change in exercise cognitions and physical activity

Six months prior to surgery, 10 out of the 42 participants (24%) participated in sports. One year and two years after surgery 29 (69%) and 28 (67%) of the 42 participants participated in sports. Table 1 shows the means and standard deviations of the physical activity scores six months before, and one and two years after surgery. One year after surgery, the scores on the Baecke sport index for physical activity were significantly increased (the magnitude of this change was large, $d = .80$). All exercise cognitions were also changed in a favourable direction one year after surgery compared to six months before surgery. This difference was small for 'confidence', medium for 'exercise benefits' and 'fear of injury' and large for 'embarrassment'. Compared to the scores after the first year, physical activity and exercise cognitions did not change in de second year after surgery.

The correlation between pre-surgical 'fear of injury' and 'fear of injury' one year after surgery was $r = .31$ ($p < .05$), and the correlation between 'fear of injury' one and two years after surgery was $r = .75$ ($p < .01$). For 'embarrassment' these correlations were $r = .63$ ($p < .01$) and $r = .68$ ($p < .01$), for 'exercise benefits' $r = .56$ ($p < .01$), and $r = .58$ ($p < .01$), and for 'confidence' $r = .78$ ($p < .01$), and $r = .76$ ($p < .01$).

Table 1. Physical activity and exercise cognition scores of 42 patients before and one and two years after surgery

Physical activity and exercise cognitions	6 months pre-surgery		1 year post surgery				2 years post surgery			
	Mean	SD	Mean	SD	p^c	*d*	Mean	SD	p^d	*d*
Physical activity[a]										
Sport Index	2.0	0.6	2.5	0.7	< .001	0.8	2.5	0.7	0.89	-0.06
Exercise cognitions[b]										
Fear of injury	26.5	8.4	20.9	8.5	< .001	-0.7	20.0	8.7	0.70	-0.10
Embarrassment	31.9	8.9	24.1	10.6	< .001	-0.8	24.1	9.7	0.29	0.00
Exercise benefits	30.8	6.5	33.6	5.0	< .001	0.5	33.1	6.1	0.61	-0.09
Confidence	15.0	6.1	16.8	6.0	< .001	0.3	16.2	6.4	0.76	-0.09

[a]Baecke physical activity questionnaire
[b]PEBQ: Physical Exercise Belief Questionnaire
[c]Test of difference between values six months before and one year after surgery
[d]Test of difference between values one and two years after surgery

The predictive value of exercise cognitions before surgery

Table 2 shows the correlations of predictor variables six months before surgery with the physical activity level and change two years after surgery. The physical activity level before surgery was not significantly correlated with physical activity two years after surgery (p = .14). Obviously, the correlation of physical activity levels before surgery with change in physical activity levels was zero, because this change score was statistically adjusted for differences in physical activity levels before surgery.

BMI (p = . 17), age (p =.16), and education level (p = .90) were neither significantly correlated with physical activity levels two years after surgery nor with change of physical activity during the pre-to-post surgical time interval (p = 0.18, p = 0.36, p = 0.97).

The negative exercise cognitions 'fear of injury' (p = .14) and 'embarrassment' (p =.72) did not correlate with the physical activity sport index two years after surgery, but the positive exercise cognitions 'exercise benefits' (p = .02) and 'confidence' (p = .02) were correlated with higher physical activity levels two years after surgery. The pre-surgical score of 'exercise benefits' was also correlated with the increase in physical activity from before the operation to 2 years after surgery (p = .04). Pre-surgical 'confidence' just failed to be significantly correlated to the change in physical activity (p = .05).

Table 2. Correlations of predictor variables six months before surgery with physical activity level and the baseline-adjusted change in physical activity two years after surgery

Predictor variables six months before surgery	Physical activity two years after surgery	
	level	change
Physical activity	.23	.00
Person Characteristics		
Body mass index	-.23	-.22
Age	.22	.15
Education level	.02	-.01
Exercise cognitions		
Fear of injury	-.23	-.15
Embarrassment	-.06	.06
Exercise benefits	.36 *	.32 *
Confidence	.35 *	.30

* $p < .05$

The predictive value of exercise cognitions one year after surgery

Table 3 shows the correlations of predictor variables one year after surgery with the physical activity level and change two years after surgery. Physical activity one year after surgery was strongly correlated with physical activity two years after surgery ($p < .001$).

BMI at one year after surgery was significantly correlated with physical activity levels ($p = .02$) two years after surgery, but it was not predictive of the baseline (i.e., at one year) adjusted change in physical activity during the second year after surgery ($p = .16$).

Age ($p = .42$) and education level ($p = .61$) were not correlated with the change in physical activity during the second year after surgery.

The negative exercise cognition 'fear of injury' at one year after surgery was correlated with reduced physical activity two years after surgery ($p = .01$) and this cognition was also a significant predictor of less change in physical activity during the second year after surgery ($p = .02$). The positive exercise cognition 'exercise benefits' was correlated to physical activity two years after surgery ($p = .03$), but it was not predictive for the baseline adjusted change in physical activity ($p = .71$).

Table 3. Correlations of predictor variables one year after surgery with physical activity level and the baseline-adjusted change in physical activity two years after surgery

Predictor variables one year after surgery	Physical activity two years after surgery	
	level	change
Physical activity	.68 **	.00
Person characteristics		
Body mass index	-.35 *	-.23
Age	.22	.15
Education level	.02	-.01
Exercise cognitions		
Fear of injury	-.42 **	-.37 *
Embarrassment	-.21	-.19
Exercise benefits	.33 *	.06
Confidence	.29	.15

* $p < .05$, ** $p < .01$

DISCUSSION

After bariatric surgery both physical activity and exercise cognitions were shown to become more healthy. Exercise cognitions before surgery and one year after surgery predicted physical activity two years after surgery.

After surgery the number of patients actively engaged in sportive activities had almost tripled. Moreover, a decrease in fear of injury and embarrassment and an increase in beliefs about exercise health benefits and confidence were observed, with the largest changes in fear of injury and embarrassment. Because lack of physical activity is a metabolic risk factor independent of body weight, the postsurgical increase in physical activity is a favourable health change, regardless of the weight lost. The observation that also exercise cognitions favourably changed, implies that people really change their attitude towards physical activity which might play a role in endurance of changes in physical activity.

After bariatric surgery, psychological variables commonly change in a favourable direction[35-37]. It has been found that post surgical weight loss is not predicted by pre-surgical psychological variables, but rather, that the operation is necessary to discover who will need extra psychological support[23, 31-34]. Our results do not support these findings for the prediction of physical exercise

from preoperative exercise cognitions. Exercise promoting cognitions before surgery turned out to be predictors of physical activity after surgery. Not regarding oneself a sportive type of person and not perceiving physical exercise as something beneficial for health were predictive of actual exercise behaviour 2 ½ years later. Many obese people once experienced bullying when performing physical exercise at school[38] and most obese people do not experience much pleasure from physical exercise[39]. This may have settled low confidence in sportive capabilities and dislike of sports as a rather stable characteristic. Indeed, 'exercise benefits' and 'confidence' showed less changes in the period from pre- to post-surgery than the other cognitions. Their greater stability may also explain why these pre-surgical cognitions are predictive of physical activity so many years later. A clinical implication of our finding could be that postoperative physical activity could be improved by pre-surgical interventions targeting the belief that exercising is not beneficial for health and low confidence in sports participation.

The negative cognitions 'fear of injury' and 'embarrassment' showed larger changes after surgery compared to the positive cognitions. Fear to get injured as a result of physical exercise one year after the operation predicted reduced physical activity in the second year after surgery. The role of fear in restraining from physical activity has been extensively examined in patients with chronic pain and is explained by the fear-avoidance model[40]. This model explicates that, if pain is (mis) interpreted as being threatening, avoidance of physical activity results and this subsequently has a negative impact on musculoskeletal function, physical performance and fitness[41]. The present study confirms the suggestion that, comparable to chronic pain patients and the findings in sedentary but otherwise healthy overweight adults[42], fear of injury can be a barrier to engage in physical activity and a contributor to the sedentary state of patients after bariatric surgery. When someone avoids physical activity due to fear, the fear cannot extinguish. To deal with fear of injury, it is recommended to carefully choose and gradually build up exercise programmes[39, 43] with little risk for injuries and much pleasure for patients. Programmes in water such as aquajogging can be suitable for this purpose[44], but also lifestyle activities that are not directly related to regular sports can be applied such as walking, biking, or dancing.

There are some strengths and limitations in our study. A strength is the longitudinal design, which allowed the prediction of physical activity from exercise cognitions. A limitation is the high proportion of incomplete questionnaires leaving a small number of participants with a relatively high education level, which hampers generalisability of the findings. Although on a group level no changes in the second year after surgery were observed and the second year is considered an important year in which weight maintenance rather than weight loss is the aim, another limitation might be

the relatively short follow up time of two years after surgery. Finally, as an adjunct to the self-report measures for physical activity including all activities of daily life, more objective monitoring of physical activity with actometers or accelerometers could be used in replication research of the current research questions.

In conclusion, physical activity and exercise cognitions substantially improve after surgery. Not perceiving the benefits of exercise and lacking confidence in ones' exercise abilities as well as fear of injury may obstruct postoperative physical activity. This suggests that physical activity might be improved by timely targeting these cognitions.

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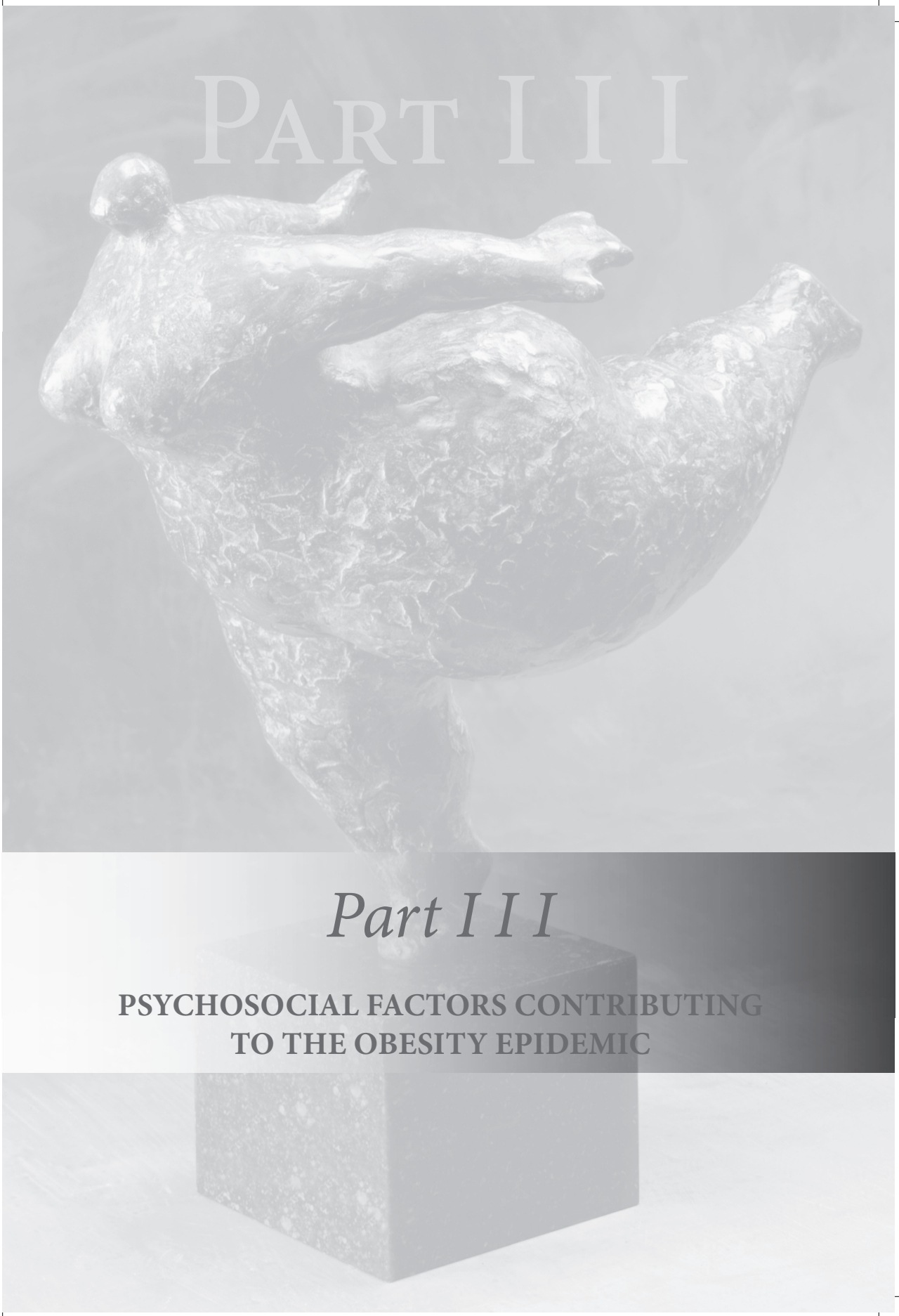

Part III

PSYCHOSOCIAL FACTORS CONTRIBUTING TO THE OBESITY EPIDEMIC

10

Chapter 10

Menarcheal status of adolescent girls is associated with depressive mood and body weight, but the underlying mechanisms appear different

Wouters EJ, Larsen KL, Dubas JS, Geenen R. Menarcheal status of adolescent girls is associated with depressive mood and body weight, but the underlying mechanisms appear different. In revision.

ABSTRACT

Background: The separate fields of depression and overweight suggest that advanced pubertal status is implicated in the increasing prevalence of both depression and obesity, in particular among adolescent girls. Yet it is not clear whether these are related or independent processes.

Purpose: It was examined whether depressive mood, body weight, and pubertal status among adolescent girls are associated due to a single underlying factor.

Method: We conducted a cross-sectional study. In 962 young adolescent Dutch girls (age range: 11.9 – 15.9) weight and height measurements were used to calculate age and gender standardised body weight (zBMI). Questionnaires assessed depressive mood (the Centre for Epidemiological Studies-Depression, CES-D, inventory) and menarcheal status (pre or post).

Results: Menarcheal status was correlated with body weight (r = .34, p < .001) and this association was not affected by depressive mood. Menarcheal status was correlated with depressive mood (r = .19, p < .001) and this correlation was not affected by body weight. A small correlation between depressive mood and body weight (r = 0.12, p < .001) largely disappeared after controlling for menarche (r = .06, p = .07).

Conclusion: The associations between menarcheal status and depressive mood and between menarcheal status and body weight are independent processes. The association between depressive mood and body weight is weak and explained by menarcheal status. Our findings suggest that different mechanisms underlie the post-menarcheal increased prevalence of depression and overweight.

INTRODUCTION

Overweight and depression are prevalent health problems that are both related to cardiovascular and metabolic disorders[1-4]. Studies of overweight and depression have mainly evolved as two independent disciplines[2], although overweight and depression are associated in adulthood, especially among women[5-7], and evidence has been provided for time-lagged associations between adolescent overweight and adult depression[8, 9] as well as between adolescent depression and adolescent and adult overweight[10-12]. Overweight may facilitate depression due to low self-esteem and body dissatisfaction[13]. Conversely, depression may facilitate overweight due to reduced physical activity[14], increased eating[15], reduced self-regulatory strength[16], and low self-efficacy[17]. Moreover, similar biological mechanisms may be involved in both mood regulation and body weight[18] such as predisposing genotypes[2], serotonin[18], leptin[19], and the hypothalamic-pituitary-adrenal system[18]. Puberty is a significant period for the onset and increase of both depression, and obesity, especially among girls[20, 21]. Findings from the separate research fields of depression and overweight suggest that pubertal status, rather than age, may explain the increases of depression and obesity, with this influence being most apparent among girls and in advanced pubertal stages[22-25]. To date, only one study simultaneously examined and verified an association between puberty, depressive symptoms and obesity[26]. The aim of our study was to examine the hypothesis that a single factor underlies the association between pubertal status, depressive mood and body weight among adolescent girls. Menearcheal status, as a clearly identifiable stage of pubertal development, and physical measures of weight and height were used. Mediational analyses examined bivariate associations between menarcheal status, depressive mood, and body weight, while partialling out the other variable.

METHOD

Design and procedure

A cross sectional design was used. Data from the current study are drawn from the baseline data that are collected as part of an ongoing study entitled the “Mental Health and Health Habits” study. Seven high schools in the Netherlands participated; three schools were located in cities, four in a suburban environment. An information letter describing the goal and procedure of the study

was sent to all parents (N = 2216) who either e-mailed or telephoned the research office if they did not consent to their child's participation. A sample of 2051 adolescents (1056 boys and 995 girls) completed the first wave of data collection, with non-participation resulting from parental or participants' denied consent, absence on the day of testing, or moving out of the school system. Details of the study have been described elsewehere[27]. For the purpose of the present study, only the data of the girls were analysed. Schools were visited by trained researchers and graduate students from February until May 2007. A ten-page questionnaire was completed by adolescents during regular lesson time in the presence of a researcher. Weight and height measurements were performed individually out of sight of classmates. For confidentiality, a numeric code was used to identify adolescents. The study has been approved by the Institutional Ethical Committee (Radboud University Nijmegen).

Participants

Participants were adolescent girls who followed regular secondary education in the Netherlands. The mean age of the girls was 13.8 years (standard deviation 0.7, range: 11.9 - 15.9), the mean Body Mass Index (BMI, calculated as weight divided by the square of height in meters) was 20.0 kg/m^2 (standard deviation 2.9, range 13.6 – 32.0). The majority of the girls (95%) was of Dutch origin.

Measurements

BMI

Height was measured to the nearest 0.5 cm (Seca 214) and weight to the nearest 0.1 kg (Mettler PM 3000), with participants wearing light clothes and no shoes. Age was calculated to the nearest month from the date of birth and date of measurement of participants. Using the Centers of Disease Control and Prevention data, age and gender standardised BMI scores (zBMI) were calculated[28].

Depressive mood

To measure depressive mood, the Dutch version of the Centre for Epidemiological Studies Depression (CES-D) inventory was used. This 20-item self-report scale has been used and found suitable for adolescents[29] and has recently been validated in a large Dutch sample[30].

Pubertal development

In the self-report questionnaire about menarcheal status pubertal development was determined by asking: "have you begun to menstruate?", with dichotomous answering possibility "yes" and "no". Menarche is an objective and relatively late pubertal event occurring in the majority of cases when at least Tanner stage 4 on breast development has been attained[31].

Socio-economic status

Participants' educational track, as a proxy measure of socio-economic status, was assessed on a 7-point scale, with level 1 and 2 reflecting pre-vocational education, level 3, 4 and 5 intermediate and level 6 and 7 pre-university level.

Statistical analyses

To examine whether or not a third variable played a role in the correlation between two variables, partial correlation coefficients (controlling for education level) were calculated in order to analyse the bivariate associations between standardised BMI, depressive mood and menarche before and after taking account of the third variable. To further test whether or not a single underlying factor explained the correlations, mediational analyses according to common procedures were applied[32]. In the first step, the association between predictor and potential mediator was determined. In the next step, regression analysis was performed to test the association between predictor and outcome variable, controlling for the mediator. If the association was reduced significantly (Sobel test), this was considered to indicate mediation. To illustrate the observed bivariate associations, odds ratios were calculated to estimate the chance at a high score on one variable from having a high score on the other variable. For this purpose cut-off points for low and high scores for body weight and depressive mood were defined at one standard deviation above the mean of zBMI and CES-D scores, respectively.

Standardised body weight and education level were normally distributed (skewness < 1). Although depressive mood (CES-D) was positively skewed (1.62), it was decided to not resort to nonparametric statistics or to improve normality by transforming variables for three reasons. First, it was considered not valid to change these scores by logarithmic transformation, because this would inflate unimportant differences between lower scores and it would deflate meaningful differences between girls moderately high and high on depressive mood. Second, transformation to ordinal scores was considered not appropriate because of the impossibility to adjust nonparametric scores for the effect of the covariates education level, body weight, depressive mood, and menarche.

Third, exploration of the score distribution showed that the deviation from the normal distribution was small and that the score distribution was continuous without gaps at the positive tail.
All significance tests were 2-tailed and *p* values less than .05 were considered to be significant. Analyses were performed using SPSS version 16.

RESULTS

Descriptives

Of the sample of 995, 962 girls (97%) with complete data on the variables of interest were included in the analyses. The groups with complete and incomplete measurements showed no differences with respect to education level, body weight, depressive mood, and menarche. Table 1 shows the descriptive statistics. The depression (CES-D) scores for girls in our sample were comparable to the scores of a recent Dutch school sample[30]. The percentage overweight adolescents in our sample (13%) was lower compared to the Dutch adolescent population (17%)[33].

Table 1. Descriptive statistics of 962 adolescent girls

Age: mean ± SD (range)	13.8 ± 0.7 (11.9 -15.9)
Education level: mean ± SD (range)	5 ± 2.1 (1-7)
Standardised weight (zBMI): mean ± SD (range)	0.10 ± 0.85 (-3.10 - 2.09)
Depressive mood (CES-D[a]): mean ± SD (range)	11.0 ± 9.2 (0 - 52)
Post menarcheal status (%)	71%

[a]CES-D: the Centre for Epidemiological Studies-Depression

Correlational analyses

Figure 1 displays the correlations between standardised body weight, depressive mood and menarche before and after adjustment for the other variable. All analyses were corrected for education level.
The correlation between body weight and menarche was of moderate magnitude (r = .34) and highly significant (p < .001). The correlation remained about similar after removal of the effect of depressive mood (r = .33, p < .001). The Sobel test (p = .12) confirmed that the severity of depressive mood did not play a role in the correlation between body weight and menarche.

The correlation between depressive mood and menarche was of small magnitude (r = .19) and highly significant (p < .001). This correlation remained about similar after removal of the effect of body weight (r = .16, p < .001). The Sobel test (p = .07) confirmed that increased body weight did not play a role in the correlation between depressive mood and menarche.

The correlation between depressive mood and body weight was of small magnitude (r = .12), though highly significant with this large sample size (p = .002). The correlation significantly reduced after removal of the effect of menarche resulting in an almost zero correlation (r = .06, p = .07). Sobel test confirmed that the small correlation between depressive mood and body weight was to a significant extent explained by menarche (p < .001).

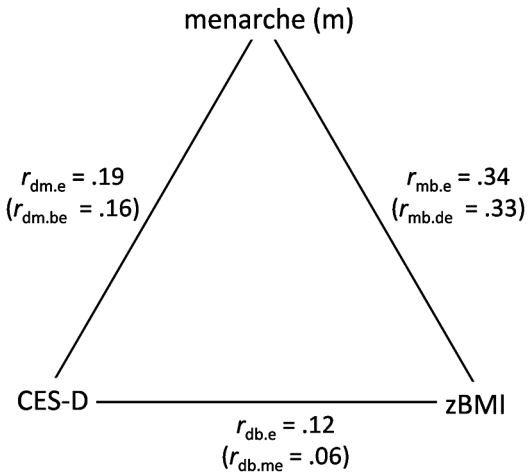

Figure 1. Partial correlations between standardised body weight (b), depressive mood (d) and menarche (m) before and after adjustment for the other variable. All correlations were adjusted for education level (e).

Odds Ratios

Odds Ratios (OR's) were calculated as estimators of the chance at depressive mood, overweight and being pre- or post-menarcheal. Compared to pre-menarcheal girls, post-menarcheal girls showed a two times higher chance for a relatively high standardised body weight (*OR* = 2.0, p < .001) and a three times higher chance at a relatively high depressive mood (*OR* = 2.97, p < .001). The chance at a depressive mood was more than two times higher when having a high standardised body weight (*OR* = 2.2, p < .001).

DISCUSSION

Our study examined the hypothesis that a single factor may underlie the association between depressive mood, body weight and pubertal status (menarche) in adolescent girls. Advanced puberty in girls was related to body weight and to depressive mood, but these associations were independent. The association between depressive mood and body weight was weak and explained by menarcheal status.

Advancing pubertal stages in girls go along with rises in body weight. Puberty rather than age has been observed to be important for the subsequent development of excess weight[23, 34]. Our study confirms this observation. A moderately high correlation between menarcheal status and age-corrected body weight was found. This may reflect that after menarche growth in height has essentially stopped, resulting in a relative higher chance of gaining excess body weight as expressed in the weight-height ratio BMI. Another possible mediating factor is that girls tend to become less physically active with progressive maturation[35]. In addition, unhealthier dietary behaviour[36] and overweight in young girls is associated with earlier onset of puberty and it is thought that hormones such as leptin, released form the adipocytes, may play a role here by stimulating the hypothalamic pituitary gonadal axis to increase the production of sex steroids[37]. Finally, a third factor may explain the association between pubertal status and excess body weight. For instance, a shared genetic predisposition may affect the development of both fertility and obesity[38]. The association between menarcheal status and excess body weight is not unexpected given the manifold of mechanisms that may explain this correlation.

Advanced pubertal stage is also accompanied by higher rates of depression. In this association maturation of the hypothalamic pituitary gonadal axis and pubertal timing have also been postulated as a possible underlying mechanism[22]. Depression may be linked with the hypothalamic and pituitary activity in different ways and at different times than obesity[18,39]. In girls, early maturation has been consistently associated with elevated levels of depressive symptoms[40]. However, several complementary and sometimes complex processes may explain this association. For instance, psychosocial variables like father absence can result in both depression and early menarche[22, 41, 42]. Actually, pubertal development as a biological phenomenon occurs in a psychosocial context. The increased likelihood of multiple, simultaneous social changes occurring during the adolescent period (in school, friends and family), together with increased vulnerabilities resulting from cognitive (e.g., body objectification consciousness) and affective (emotional reactivity) changes, all coalescence with pubertal changes to increase the risk of depression among adolescent girls[43, 44]. Our analyses

showed that although menarcheal status was correlated to both body weight and depressive mood, these associations were not affected when controlling for the other variable. This convincingly suggests that separate mechanisms play a role in the association between puberty and overweight and the association between puberty and depressive mood in adolescent girls.

Although several studies have found a correlation between depression and overweight in adult women[5-7], the concomitant occurrence of adolescent depression and overweight is far less clear[45]. Likewise, in our study, the association between depressive mood and body weight was found to be weak. This might be considered unexpected, because obesity in adolescence predicts adult depression and depression in adolescence predicts adult obesity[8-11, 46]. These are correlations with a time lag instead of cross-sectional correlations. The combined results of insignificant cross-sectional associations in adolescence and significant prospective adolescence-adult associations may suggest that the one problem may induce the other problem only after some time or that the time lag of the development of overweight and depression is different. For instance, reduced physical activity and increased eating may explain why depressive mood prospectively predicts obesity[2]. The weak correlation between body weight and depressive mood in our study was largely explained by menarche. This suggests that most of the association between depressive mood and body weight[18] is explained by the concomitant higher chances at depressive mood and overweight in advanced puberty. After menarche girls are at risk both for depression and obesity, but different mechanisms are involved.

In our study, the small correlation between depressive mood and body weight largely disappeared after controlling for menarche. A previous study did not compute such a correlation, but observed that obesity was still predicted by depressive symptoms after adjustment for pubertal phase[26]. In analogy to the results of this study, in our study the chance at a depressive mood was more than two times higher when having a high body weight. This likely suggests that above a certain cut-off of obesity, the chance at a depressive mood increases. Our analyses done in the whole group suggested that the small correlation between depressive mood and obesity was mostly explained by puberty being an independent predictor of both depressive mood and obesity. In our study and in the previous study[26], the correlations between pubertal stage and body weight (r = .34 and r = .40) and between pubertal stage and depressive symptoms (r = .19 and r = .20) were of the same magnitude. New information added by our study is that these correlations remained of the same magnitude when the puberty-weight correlation was corrected for the possible impact of depression and when the puberty-depression correlation was corrected for the impact of body weight.

Our study has strengths and weaknesses. The study design was cross-sectional. Although causal

inferences cannot be drawn from correlations, rejection of causal relationships is indicated by the absence of association, as in the case of the small correlation between depressive mood and body weight being reduced after correction for menarcheal status. Future longitudinal research measuring depressive mood and weight change will give more information about the temporal relationship between development of body weight and depressive mood in adolescent girls. We used menarche as a measure for advanced pubertal stage in girls. Although this is a rough measure of pubertal stage, it is an accurately reported and more objective measure than puberty characteristics such as breast growth, and it is well associated with advanced pubertal stage in girls[47]. Our depressive mood scores were not dissimilar from other studies[30], but the percentage of overweight in our sample was somewhat below the Dutch average[33], a difference that may be due to the relatively high education level of our sample. Strengths of our study were the large sample size, the use of objective weight and height measurements instead of self reports, and the investigation of bivariate correlations while controlling for the effect of a third variable.

In conclusion, our study did not find support for the idea that one common mechanism may underlie the relationship between depressive mood, body weight and pubertal status. The association between depressive mood and body weight is only weak and it is predominantly explained by menarcheal status. This suggests that different mechanisms underlie the post-menarcheal increased prevalence of depression and overweight.

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11

Chapter 11

Peer group and school influence on snacking behaviour in adolescence

Wouters EJ, Larsen JK, Kremers SP, Dagnelie PC, Geenen R. Peer group and school influence on snacking behaviour in adolescence. In revision.

ABSTRACT

To examine the association of adolescents' snack and soft drink consumption with peer group snack and soft drink consumption, availability of snacks and soft drinks at school, and person characteristics, snack and soft drink consumption was assessed in 749 adolescents (398 girls, 351 boys, age 12.4 - 17.6 years), and their peers, and snack and soft drink availability at schools was measured. In regression analysis, consumption by peers, snack and soft drink availability within school, and person characteristics (age, gender, education level, body mass index) were examined as determinants of snack and drink consumption. Snack and soft drink consumption was higher in boys, soft drink consumption was higher in lower educated adolescents, and snack consumption was higher in adolescents with a lower body weight**.** Peer group snack and soft drink consumption were associated with individual intake, particularly when availability in the canteen and vending machines was high. The association between individual and peer snack consumption was strong in boys, adolescents with a lower education level, and adolescents with lower body weights. Our study shows that individual snack and soft drink consumption is associated with specific combinations of consumption by peers, availability at school, and person characteristics.

INTRODUCTION

Obesity is a complex and often chronic health problem resulting from the interaction of metabolic, genetic, environmental, and psychological factors[1]. Overweight often develops early in life and tracks into adulthood[2], causing a serious burden during and beyond childhood[3]. Adolescence, with its rapid changes in body composition[4] and food habits, coinciding with the transition from the direct home influence to the peer-related environment[5], is likely to be a particularly vulnerable period in the onset of obesity.

Ecological models examine the problem of obesity by regarding both the individual disorder and the abnormal environment[6, 7]. Easily available unhealthy food is an important representative of the so called physical 'obesogenic' environment[8-11]. Schools play an important role in the consumption of unhealthy food among adolescents. Availability of snacks at school has been associated with unhealthier food habits of secondary school pupils, and changing the canteen policy, e.g., by decreasing portion sizes, influenced energy balance in a favourable way[12, 13].

Besides the physical school environment that supplies food, we propose that also the social environment plays a role in determining unhealthy food intake among adolescents. During adolescence, children spend increasingly more time with peers, and their need to belong to a group and to be accepted by peers is higher than during other periods in life[14]. Social learning theory specifies that peers may influence each other by observing, modelling, and imitating behaviour of important individuals in their environment[15]. Group norm setting is also a powerful mechanism in determining an individual's behaviour[16]. Prospective research suggested that peers influence each other in a wide range of health behaviours, e.g., smoking[17], alcohol consumption[18], and disordered eating[19]. Social networks have also been found relevant for the spreading of obesity in adults[20]. The cross-sectional design of the current study cannot disentangle influence processes from selection processes such as similar adolescents choosing each other as friends. However, this is the first study to examine similarities in snack and soft drink consumption within peer groups. To establish this relationship is an important first step before examining the precise causal mechanisms.

As snack consumption contributes to obesity[21], it is important to gain insight into its possible determinants in adolescents. An accurate reflection of the variables impacting on adolescent's snacking behaviour should take into account aspects of the physical and social environment, as well as personal characteristics[22]. With regard to personal characteristics, boys[23, 24], lower educated[25], and overweight children[26, 27] are reported to consume more unhealthy food. These personal characteristics were included in the study. The aim of the present study was to examine

the association of adolescents' snack and soft drink consumption with peer group snack and soft drink consumption (social environment), availability of snacks and soft drinks at school (physical environment), and personal characteristics. Our hypotheses were (1) that all variables significantly predict individual snack and soft drink consumption and (2) that the availability of snacks and soft drinks within schools moderates the association between peer group snacking and individual snacking.

METHODS

Population and design

This cross sectional study was part of a larger project called 'Mental Health and Health Habits'[28]. Five secondary schools in the Netherlands participated in the current study. Only schools without any change in school food policy or food availability between the measurement of participants and the observation of the school environment were included. A sample of 1330 adolescents (684 boys and 646 girls) completed data collection, with ten percent non participation resulting from parental or participants' denied consent, absence on the day of testing, or moving out of the school system. Adolescents' mean age was 14.9 years (range 12.4 - 17.6 years), and the majority (over 95%) was of Dutch origin. All participants followed regular secondary education. The study received institutional ethical approval.

Procedure

Questionnaires were completed in a classroom during a lesson. Height and weight were measured out of sight of class mates. Adolescent data were collected in spring 2008 and school environment data were collected in summer 2008 during normal school days.

Demographic variables

Age was derived from date of birth and date of measurement. Education of the adolescents was assessed on a six-point scale, level one and two reflecting pre-vocational education, level three and four intermediate education, and level five and six pre-university education.

Height and body weight

Height was measured to the nearest 0.5 cm (Seca 214, Hamburg, Germany), and weight to the nearest 0.1 kg (Mettler PM 3000, Greifensee, Switserland), with participants wearing light clothes and no shoes. Body Mass Index (BMI, kg/m²), and age and gender standardised BMI (zBMI) scores were calculated. Overweight was defined as zBMI at or above the 85th percentile[29, 30].

Snacking behaviour

Snacking behaviour was defined as the consumption of snacks and carbonated soft drinks[25, 31]. Snack consumption, i.e., consumption of sweet or savoury palatable food products such as candy bars, nuts, chips and cheese, was measured with the five relevant questions of the Fat list, a brief food frequency questionnaire to categorise dietary fat intake[32]. The Fat list has been shown a valid instrument in populations to classify subjects in broad categories of total and saturated fat intake in grams, and to assess differences in absolute and saturated fat intake between groups as a result of nutrition education programmes[32]. The questionnaire has been frequently used in adolescents[11, 33, 34]. It was in a small sample suggested to be more valid in male than female adolescents[32]. Participants were asked how frequently the snack items listed were usually consumed. For each of the five mentioned categories a score from one (less than once a week) to eight (seven days a week) was determined. A total summary score for snack consumption was calculated. The amount of consumed carbonated soft drinks was assessed by five answering categories, ranging from zero glasses each day (score 1) to more than six glasses per day (score 5).
Peer group snacking behaviour was defined as the mean score of snack (or soft drink) consumption for an established peer group after subtraction of the individual score[35].

Peer group identification

To define peer groups, participants named a maximum of five of their best friends in the class[18], starting with their most important friend, then the second best friend, and so on[36]. Peer group structure was identified by social network analysis, which identifies patterns of relationships between persons[37]. Adolescents could be assigned to three possible positions: friendship clique membership, dyads, and isolation (figure 1). Friendship clique members are adolescents belonging to a peer group of at least three persons[36]. Dyads were excluded from the sample, because groups of two persons function differently from larger groups[35]. The allocation to clique membership was restricted to

members with reciprocal ties (bilateral nominations). If more than one clique was eligible, membership was decided by position nomination of the members (giving more weight to friends who were nominated as closer friends).

To control consistency of the results, also a clique definition that allowed unilateral nominations was used. In this definition at least two of the ties within a clique had to be reciprocal.

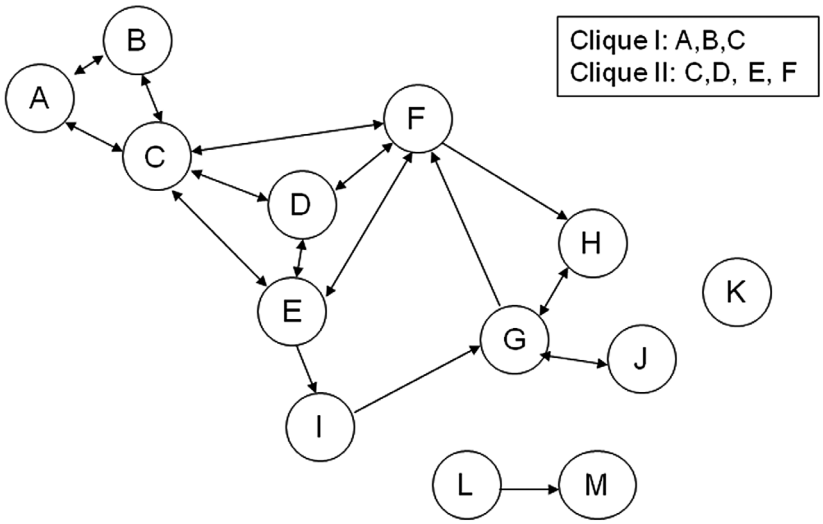

Figure 1: Two examples of cliques in a social network.

School availability of snacks

The availability and accessibility of energy dense snacks and sugar sweetened soft drinks in the school were determined by counting all visible items (rows) in the school vending machines and in the school canteen using an instrument from the ENDORSE (ENvironmental Determinants of Obesity in Rotterdam SchoolchildrEn) study[38]. Exposed rows of candy bars, chocolate, chips, cake, ice creams, warm savoury snacks, high caloric biscuits, cakes, and energy dense sugar-sweetened beverages were counted. A summary score, both for snacks and for soft drinks, was used for school canteens and for school vending machines.

Statistical analyses

Descriptive analysis was used for evaluation of demographic variables. Only adolescents who could be assigned to a friendship clique were analysed. Independent samples *t*-tests compared these variables for adolescents who were and were not assigned to a clique. Linear regression analysis, with individual snack consumption and individual soft drink consumption as the outcome measures, revealed the relative importance of the predictor variables friendship clique consumption (social environment), availability within schools (physical environment), and age, gender, and education level of the participant (personal characteristics). BMI was entered as a covariate. In step 1, age, gender, education level, and BMI were entered. In steps 2 and 3 the mean friendship clique consumption and availability within schools followed, respectively. In step 4, individual consumption was associated with the above variables, and the interaction of clique consumption with the availability within school of snacks and soft drinks, age, gender, education level, and BMI, respectively. To interpret significant interactions, regression lines for individuals low (-1 *SD)* and high (+ 1 *SD*) on the one predictor variable were plotted for low (- 1 *SD*) and high (+ 1 *SD*) values of the other predictor variable[39]. Cohen's *d* was used as effect size measure: for high (+1 *SD*) and low (-1 *SD*) values of either predictor variable, the difference of individual consumption scores of persons with high (+1 *SD*) clique consumption and low (-1 *SD*) clique consumption was divided by the pooled standard deviation[40]. Effects sizes are defined as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$)[40].

The UCINET programme identified friendship cliques[41]. All other analyses were conducted using SPSS, version 16.0. Alpha values < .05 were considered statistically significant.

RESULTS

Description of the sample

Of the original sample of 1330, 749 adolescents with complete data on all variables were part of a clique. This sample showed no differences with the non-clique sample with respect to age, BMI, and snack consumption. The clique sample, as compared to the non-clique sample, included more girls (53% and 46%, respectively) and had a higher education level (means: 4.7 versus 4.4). All variables were normally distributed. Table 1 shows the descriptive statistics of the 749 adolescents of the research sample. Participants had a mean age of 14.9 years, a mean BMI slightly above

the norm value, and a relatively high education level. Friendship clique size ranged from three to five adolescents: 65% of the cliques consisted of three, 30% of four, and 5% of five adolescents. Table 2 presents the mean number of different snacks and soft drinks that were available within the schools. Only the score distribution of snacks in the vending machines was not normal. This variable was not transformed, because the somewhat skewed score distribution was based on true variation and logarithmic transformation would inflate unimportant differences between lower scores and deflate meaningful differences between higher scores.

Table 1. Descriptive statistics of 749 adolescents belonging to a friendship clique

	Percentage	Mean	(Range)
Age (years)		14.9	(12.4 -17.6)
Gender (% female)	53		
Education level[a]			
pre-vocational	15		
intermediate	29		
pre-university	56		
Weight (kg)		59.6	(35 - 119)
Height (m)		1.70	(1.45 - 1.96)
Body mass index (kg/m^2)		20.7	(14.4 - 38.6)

[a]Education level was assessed on a six-point scale, level one and two reflecting pre-vocational education, level three and four intermediate education, and level five and six pre-university education

Table 2. The number of visible items of energy dense snacks and sugar-sweetened soft drink in schools

	Mean	(range)
Snacks in the canteen[a]	21.0	(0 - 35)
Soft drinks in the canteen[a]	2.7	(0 - 9)
Snacks in vending machines[a]	31.9	(10 - 94)
Soft drinks in vending machines[a]	13.6	(4 - 21)

[a]Items were counted as they were exposed in rows. E.g., three rows of one brand and one row of another brand was counted as 'four'

Personal characteristics, peer group snacking and availability within schools

Table 3 shows the results of linear regression analyses used to examine whether individual snack and soft drink consumption was associated with personal characteristics, peer group snacking and availability within schools. In step 1, snack and carbonated soft drink consumption was higher in boys than in girls, soft drink consumption was higher in adolescents with a lower education level, and snack consumption was higher in adolescents with a lower BMI (snack consumption for step 1: R^2 = .07, p < .001; soft drink consumption for step 1: R^2 = .13, p < .001). In step 2, clique consumption —both of snacks and of soft drinks— was associated with the individual consumption of snacks and soft drinks respectively (snack consumption for step 2: ΔR^2 = .02 , p < .001; soft drink consumption for step 2: ΔR^2 = .03, p < .001). In step 3, neither snack availability nor soft drink availability were related to snack or soft drink consumption (snack availability for step 3: ΔR^2 = .00, p = .98; soft drink availability for step 3: ΔR^2 = .00, p = .86).

Table 3. Regression analysis of individual snack and soft drink consumption predicted by person characteristics (step 1), clique consumption (step 2), and school availability of snacks and soft drinks in the vending machines and canteen (step 3)

	Individual snack consumption			Individual soft drink consumption		
Step 1	B[a]	SE B	β[b]	B[a]	SE B	β[b]
Age	0.37	0.30	.05	0.08	0.04	.07
Gender (0=boys, 1=girls)	-1.34	0.39	-.12*	-0.47	0.06	-.30**
Education level	-0.24	0.13	-.07	-0.10	0.02	-.18**
Body mass index	-0.42	0.07	-.21**	-0.01	0.01	-.02
Step 2						
Age	0.30	0.30	.04	0.06	0.04	.05
Gender	-1.05	0.40	-.10*	-0.36	0.06	-.23**
Education level	-0.21	0.13	-.06	-0.07	0.02	-.13**
Body mass index	-0,42	0.07	-.22**	-0.01	0.01	-.02
Clique consumption	0.21	0.05	.15**	0.27	0.05	.20**
Step 3						
Age	0.33	0.33	.04	0.05	0.04	.05
Gender	-1.04	0.40	-.10*	-0.36	0.06	-.23**
Education level	-0.21	0.14	-.06	-0.07	0.02	-.14*
Body mass index	-0.42	0.07	-.22**	-0.01	0.01	.02
Clique consumption	0.21	0.05	.15**	0.27	0.05	.20**
Snacks/drinks in vending machines	0.00	0.01	.00	0.00	0.01	.01
Snacks/drinks in canteen	0.00	0.02	.01	0.00	0.01	.02

[a]B: regression coefficient
[b]β: standardised regression coefficient
Note 1: *p < .01, **p < .001

Interactions with school availability of snacks and soft drinks

Individual snack consumption was predicted by the combination of clique snack consumption and the availability of snacks in the canteen (standardised regression coefficient of the interaction term $\beta = 0.10$, $p = .006$): individual snack consumption in adolescents with friends who consumed many snacks was especially high when snacks were readily available, whereas for adolescents with friends with a low snack consumption, availability of snacks was not related to individual snack consumption (figure 2 left). The effect size (d) of the difference between individuals having friendship cliques with high versus low snack consumption, in case of high availability of snacks in the canteen, was 0.48. In case of low availability of snacks in the canteen, it was 0.10. The combination of clique snack consumption and availability of snacks in vending machines showed no association with individual snack consumption ($\beta = .04$, $p = .29$).

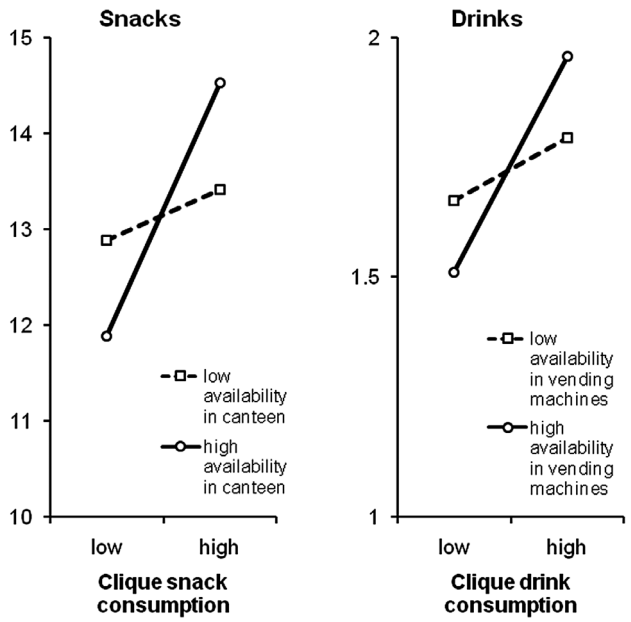

Figure 2: Individual consumption of snacks predicted by clique consumption of snacks and availability of snacks in the canteen (left), and individual consumption of soft drinks predicted by clique consumption of soft drinks and availability of soft drinks in the vending machines (right); the Y-axes represent snack consumption per week (minimum score 5, maximum score 40) and soft drink consumption per day (minimum score 1, maximum score 5).

The combination of clique soft drink consumption and availability of soft drinks in the canteen was not associated with individual consumption (β = .05, p = .11), but individual soft drink consumption was related to the combination of clique soft drink consumption and the availability of soft drinks in the vending machines (β = .09, p = .001): most soft drinks were consumed by adolescents who had soft drink consuming friends, at a school with high availability of soft drinks in the vending machines (figure 2 right). The effect size of the difference between individuals belonging to friendship cliques with high versus low consumption was 0.57 in case of high availability, and 0.16 in case of low availability of soft drinks in the vending machines.

Interactions with personal characteristics

Of the personal characteristics, the combination clique snack consumption and age did not show an association with individual snack consumption (β = .01, p = .73), but the interactions of gender (β = .24, p =. 03), education level (β = .14, p < .001), and BMI (β = .10, p = .004) with friendship clique consumption were related to individual snack consumption. When being part of a clique with a relatively high snack consumption, boys (figure 3 left), adolescents with a low education level (figure 3 middle), and normal weight adolescents (figure 3 right), individually consumed most snacks. The effect sizes of high versus low snack consumption in the clique were 0.41 (boys) and .01 (girls), 0.44 (low education) and 0.01 (high education), and 0.48 (normal weight) and 0.09 (overweight), respectively. No interactions with person characteristics were found for clique and individual soft drink consumption.

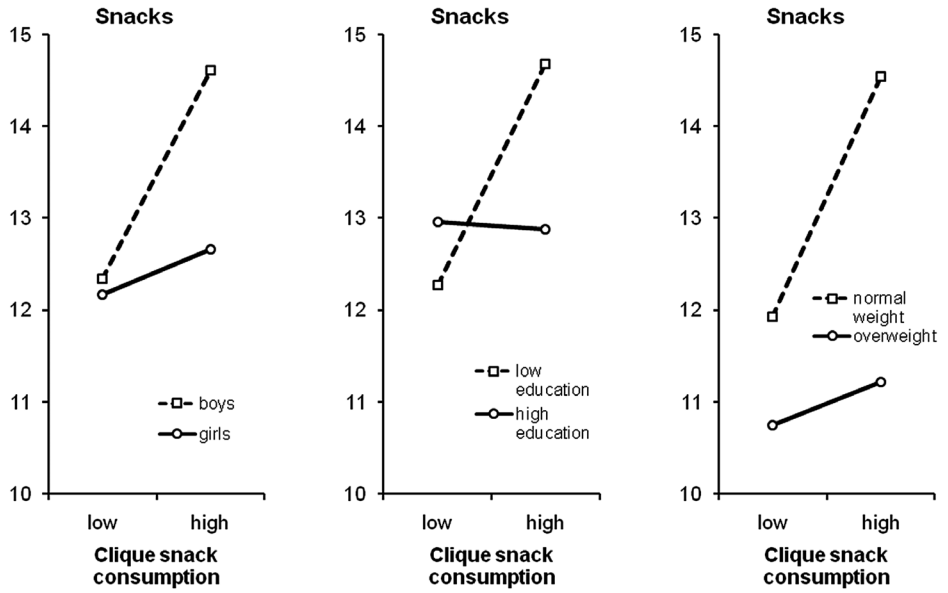

Figure 3: Individual consumption of snacks predicted by clique consumption of snacks, and gender (left), education level (middle) and weight status (right); the Y-axes represent snack consumption per week (minimum score 5, maximum score 40) and soft drink consumption per day (minimum score 1, maximum score 5).

Consistency of results

All analyses were repeated for the clique definition that allowed both unilateral and bilateral ties in 1246 adolescents. The results were similar to those with the strict clique definition with respect to all direct associations and interactions (data not shown).

DISCUSSION

Individual snack and soft drink consumption was high when peers proximate to the adolescent had a high consumption combined with readily availability within schools of snacks in the canteen and soft drinks in the vending machines. Individual and peer snack consumption was particularly strongly associated in boys, adolescents with lower education levels, and normal weight adolescents. Comparable to earlier studies[35, 42], our study suggests that snack and soft drink consumption are behaviours that are shared by adolescent friendship groups. Experimental studies specifically

focusing on food consumption, demonstrated that people adjust their food intake to the consumption of a model[43-45]. This modelling mechanism may be one mechanism promoting the association of dieting behaviour within peer groups. In adolescents, the opinion of friends about food is related to their own consumption[46]. This suggests that also norm setting influences food consumption in peer groups. Future studies should examine the proposed influencing mechanisms, as well as possible selection mechanisms, underlying the resemblance of consumption within peer groups found in the present study. Because peers share their snacking habits in a favourable or unfavourable manner, it appears fruitful in education and intervention to target both the individual snacking behaviour and the snacking behaviour of peers.

Unexpectedly, but in agreement with recent previous findings in the Netherlands[46], snack or soft drink availability at school was not associated with individual consumption. However, our study implies that availability within school is a determinant of individual snacking in combination with peer group consumption. When the school has limited or no provision of snacks and soft drinks, adolescents seem to influence each other less strongly. The present study only evaluated the availability and consumption of unhealthy food products. If our results apply to all food, the peer group might help to develop healthy dietary habits when the school supplies healthy food. This indicates the potential importance of attending to the school canteen and vending machine assortment in order to promote healthy eating in adolescents.

Boys in our study consumed more snacks and were more comparable to their peers than girls. Female gender is associated with healthier food choices, both in adults[47] and in children[27, 48]. That the quality of food consumed by girls more depends on personal factors and that boys might be more susceptible to the influence of peers[24], suggests that addressing peer groups in boys, rather than in girls, is important to change snacking behaviour.

Two findings in our study confirm the importance of considering education level with respect to the diet of adolescents[49]. First, lower education was associated with higher consumption of soft drinks, and second, more snacks were consumed by lower educated adolescents who had friends consuming a lot of snacks. Peer group education is successful in unhealthy behaviour[50, 51] and, as previously reported[52], may be stronger in persons with less formal education.

Counter intuitively, adolescents with a higher body weight consumed less snacks than normal weight adolescents. Experimental studies show that the amount of snacking increases with body weight[27]. Our study used self report to assess snacking, which could explain the contrast. Overweight adolescents are aware of weight stigmatisation[53], and energy intake is more often underreported by overweight compared to normal weight persons[54, 55]. We also observed that the

peer group effect was dependent on weight: in normal weight but not in overweight adolescents, individual and peer group snacking were associated. Besides underreporting by overweight adolescents, it is possible that they actually eat less snacks in social situations as suggested in an experimental study[56], because weight stigmatisation results in restrained eating[53]. Research linking self report and observational assessments of snacking is needed to confirm the suggestion that overweight and normal weight adolescents behave differently in groups. An implication would be that, when addressing snacking behaviour in groups, targeting normal weight adolescents is more successful than targeting overweight adolescents.

Strengths of our study are the large sample size, the objective measurements of weight, height, and snack and soft drink availability within schools, and the concomitant inclusion of social environmental (friendship cliques), physical environmental (school snack availability), and personal characteristics. Another strong point is that we used reciprocity of friendship nominations from objective sociometric data for establishing snack consumption of the friendship cliques. Also, we found similar results when applying two different clique definitions, which supports the external validity of the findings.

There are also limitations of our study. First, due to the cross sectional design, no causal inferences can be made. Prospective studies could examine whether peers affect the future snack intake of adolescents, or that adolescents select friends because of their snacking behaviour, or both. Now that we have confirmed the association between dieting habits of peers, the next step should be to disentangle the nature of this association in prospective and experimental designs. Second, assessment of the intake of new products like energy drinks were included in our observation, but not in the self report measure. Also, we only measured availability of snacks and soft drinks within school, and studied the association between availability within school and snacking in general. We did not take into account the availability outside the school environment, which might account for a substantial part of the individual snacking. This may have resulted in underestimation of the associations found in our study. Third, as suggested by a study in a small sample, the validity of the Fat list might be relatively low in adolescent girls[32]. And fourth, only five schools were included, which may hamper generalisability.

In conclusion, our findings suggest that snack and soft drink consumption are behaviours shared by adolescent friendship groups, with the strongest similarities in schools with high availability of snacks in the canteen and soft drinks in the vending machines, and, for snack consumption, in boys, lower educated adolescents, and normal weight adolescents.

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Chapter 12

General discussion

The aim of this thesis was to examine psychosocial aspects of assessment, treatment, and aetiology of obesity, with special focus on quality of life. In the first part, quality of life in obesity was described and quantified, and two assessment instruments were evaluated. In the second part, psychological aspects of physical activity, in particular the processes underlying the sedentary behaviour of overweight adults, were highlighted. In the third part, obesity was examined from an aetiological, psychosocial perspective.

The current chapter discusses the main findings, followed by a discussion of the clinical implications and recommendations for future research. Because considerable attention was paid to methodological strengths and limitations in the discussion of the separate chapters, only the most important issues will be addressed here.

DISCUSSION

Assessment of quality of life and suffering in obesity

Quality of life is severely affected in obese persons, the more in persons with higher body weights, in women, and in those who apply for bariatric surgery[1]. The reason for obese patients to seek treatment often relates to quality of life[2, 3]. Therefore, in addition to body weight and metabolic parameters, it is recommended to include quality of life in the assessment of the obese patient and in the evaluation of obesity interventions. Our meta-analysis yielded reference values for two frequently used instruments, the IWQOL-Lite and the SF-36, which are helpful when evaluating generic or obesity specific quality of life.

Until now, in studies predominantly generic quality of life instruments have been used. Nevertheless, specific obesity-related instruments have several advantages above generic instruments. These instruments have been designed to tap salient obesity issues in several domains[4, 5], are more responsive to change, and thus are more useful to evaluate interventions[6, 7]. The Dutch IWQOL-Lite is already available, and a Dutch version of IWQOL-Kids for adolescents between 11 and 19 years has been evaluated in this thesis. For still younger children, no instrument is currently available in the Netherlands.

There is a major limitation with respect to the use of quality of life instruments in general. The most frequently used generic instruments (e.g., the SF-36[8]) measure perceived health or functional status, rather than the patient's personal valuation of his or her health status, which has been considered key to the concept of quality of life[9]. In order to deal with this shortcoming, the PRISM[10, 11] has

been evaluated and applied in this thesis as an addition to the IWQOL-Lite. The PRISM measures suffering, which involves issues like concerns about the future, lack of meaning and a threat to the intactness of the person[12]. Although the PRISM is not specifically designed to be a quality of life instrument[11], it may offer a more valid reflection of the personal, intuitive valuation of quality of life problems than other instruments. The revised version of the PRISM, which eventually resulted in the PRISM-R2, proved to be a useful and easy to apply instrument, both as an outcome variable, and in the prediction of compliance to physical exercise programmes.

Psychological determinants of physical activity in obesity

Physical exercise as an indispensable component of obesity treatment, was the second theme of this thesis. Mental and physical health improve as a result of physical exercise. In obesity attained weight loss is better preserved[13-16] and quality of life is more stably improved[17, 18] if an intervention also includes physical activity. In our pilot study on the effect of an aquajogging programme, quality of life of the participants also significantly improved.

Despite the proven health effects of physical activity, most overweight or obese persons do not engage in physical activity programmes or sports, and often about 50% of those who start a programme drop out[19]. Psychological factors underlying the motivation to start physical activity may not necessarily be the same as those which influence compliance[20]. A reduced quality of life, fear for future health impairment and higher body weight have been identified as factors motivating obese people to treatment seeking behaviour (including physical activity) in obesity[2, 3, 21]. A major indication in the present thesis was that exercise cognitions, in particular fear of injury, can prevent overweight adults from exercising. Fear of injury appeared to be a barrier both in relatively healthy overweight persons from the general population, and in patients after bariatric surgery, emphasising the relevance of this cognition.

Other psychological factors may negatively influence compliance in behavioural treatment programmes, e.g., high outcome expectations, lack of self-efficacy, but also low quality of life[22]. In our study of obese patients following exercise programmes during six months, premature dropout was predicted by the degree of suffering from one's obesity problem and by perceiving a low quality of life.

The combination of studies in this thesis suggests that fearing injuries restrains overweight persons from starting physical activity, whereas suffering prevents them from successful completion of the programme.

Psychosocial factors contributing to the obesity epidemic

Obesity is multi-causally determined. Individual genetic and behavioural factors as well as environmental factors play a role in the obesity epidemic. The third part of this thesis was dedicated to aetiological (both personal and environmental) factors.

Depression often accompanies obesity and it has a negative influence on other aspects of quality of life[23-25]. Although on theoretical and biological grounds a single underlying mechanism for depression and obesity may not be excluded[26, 27], our results showed that the association between menarcheal status and body weight was not affected by depressive mood, whereas the association between menarcheal status and depressive mood was not affected by body weight. Moreover, the small correlation between depressive mood and body weight disappeared after controlling for menarche. These results suggest that different mechanisms underlie the post-menarcheal increased prevalence of depression and overweight in adolescent girls. Because the study had a cross-sectional design, no definite conclusions can be drawn about the precise nature of this relationship, but the results strongly suggest that it must be excluded that there is one common mechanism underlying both problems at the same time.

In adolescents, not only bodily appearance, but also the social (e.g., friends) and physical (e.g., school) environment change rapidly. Adolescents, influenced by peers and the school environment, are likely to develop altered food choices. My study reveals that adolescents tend to imitate the snacking behaviour of their peers. The extent of this imitation depends on gender, education level, body weight and the availability of snacks and soft drinks at school. Because the design of the study was cross-sectional, no inferences as to causality can be made. The findings suggest though, that the unhealthy food intake of teenagers is associated with the food intake of friends, the school availability of food and drinks, and personal characteristics of the adolescent.

CLINICAL IMPLICATIONS

Assessment of quality of life and suffering in obesity

The assessment of quality of life is important for research and should be an integrated part of clinical assessment, because it offers tools to prioritise problems, focus on the patient rather than on the disease, and facilitates communication with the patient[28]. In the field of quality of life assessment,

this thesis contributed to the development of quality of life instruments for patients suffering from obesity. The PRISM-R2 offers additional opportunities for clinical application by showing the extent to which a person suffers from obesity or another health problem, by facilitating self-reflection and by being helpful to open conversation with the health provider on the burden of disease.

Psychological determinants of physical activity in obesity

In dealing with obesity, in addition to changing food patterns, one of the major challenges is to stimulate sedentary overweight people to engage in physical activity. This thesis showed that overweight people may justify their sedentary lifestyle with reasons such as being busy with work or concerns about getting injured. For health care workers, physiotherapists, sports teachers and all who professionally engage with physical activity and overweight persons, recognising and addressing these barriers is of importance for successful treatment. To target fear of injury, comparable to programmes designed for low back pain patients[29, 30], graded activity may be useful. Aquajogging is a low-injury type of sports that could be used to meet this requirement.
This thesis also showed that especially the obese people suffering most from their obesity are at risk to drop out from exercise programmes. They are most in need for extra support. Obese people may have experienced life-long bullying when performing physical exercise in groups[31]. More awareness of the healthcare giver with respect to the influence of the implicit stigmatisation of obese patients and low quality of life on compliance, together with their fear of injury, will contribute to the design of both effective and sustainable exercise programmes.

Psychosocial factors contributing to the obesity epidemic

Most interventions, though possibly effective in curing the individual, have not succeeded in curing the obesity epidemic. If future research confirms the suggestion from the aetiological part of this thesis that depression and obesity originate from different causal mechanisms, this implies that in treatment both problems should be addressed separately and equally.
The observation that groups of adolescents, in particular boys, lower educated and normal weight adolescents display comparable snacking behaviour, offers opportunities to design targeted peer group interventions, comparable to the anti-smoking approach[32], in order to stimulate healthy behaviour in this age group. As an adjunct to this approach, decreasing the school availability of snacks and soft drinks can favourably affect unhealthy snacking behaviour of adolescent groups.

DIRECTIONS FOR FUTURE RESEARCH

Assessment of quality of life and suffering in obesity

With respect to obesity specific quality of life assessment, the IWQOL-Lite and IWQOL-Kids are now available in the Netherlands. Future research should further evaluate the psychometric properties of the IWQOL-Kids, especially for adolescents in a clinical setting. In addition, a Dutch obesity specific instrument for younger children should be developed. The recently developed parent-proxy[33] and child instrument[34] for the assessment of obesity-related quality of life in the U.S.A. could be translated and adapted for Dutch children. The IWQOL-questionnaires could be combined with a generic quality of life instrument or the PRISM-R2, also in children.

Psychological determinants of physical activity in obesity

In the treatment of obesity, aquajogging appears to be an especially attractive exercise option, because the low risk of injuries may reduce the fear of injury. The broad application and evaluation on physical and mental health outcomes of an aquajogging programme within conservative therapy, as well as after surgical interventions, deserves attention. Evaluation in a randomised controlled trial over a longer period of time is preferred.

To improve the studies of fear of injury as a barrier to enter a physical exercise programme, it is recommended to apply a prospective design, to include obese persons with co-morbidities, and to objectively measure physical activity, e.g., by using actometers or accelerometers. With this method physical activity is measured more accurately and other (strenuous) physical activities in daily life besides sports, can be included in the evaluation of physical activity. The integration of physical activity in daily life and the nature of the fear perceived by overweight persons need further evaluation.

Psychosocial factors contributing to the obesity epidemic

In continuation of the aetiological studies presented, further research is needed to establish the exact biological mechanisms underlying depression and obesity, such as hormones, cytokines, and brain functions and structures[35, 36]. Although there is not a single mechanism to which both depression and obesity can be attributed, long lasting prospective studies, considering more complex time-lagged models, can possibly explain the co-existence of these two prevalent health

problems. Obesity may eventually evoke depressive mood and vice versa, by several mediating biopsychosocial mechanisms, not yet fully unravelled.
With respect to the environmental factors that contribute to the eating pattern of adolescents, several lines of future research can be suggested. Longitudinal research can analyse the nature of the association of peer group and individual snacking, i.e., if the association is a result of selection (the preference for and subsequent selection of a peer group with a certain behaviour that is resembling one's own behaviour) or of influence of the peer group on the individual behaviour. Experimental research could further illuminate which processes explain the similarities in the snacking behaviour between individuals and their peer groups.

In conclusion, the present thesis yielded useful new measuring devices, insights and research questions concerning assessment, treatment and aetiology of obesity.

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Chapter 13

Extended summary

INTRODUCTION

Obesity is a chronic health problem characterised by an excess storage of fat. It is especially, but not exclusively, prevalent in industrialised countries: about one out of three Americans[1], and one out of ten Dutch adults[2] is obese. People who weigh much more than the standard for their height commonly have excessive fat stores. Therefore in adults Body Mass Index (BMI, weight in kilograms divided by squared height in meters) is often used to indicate healthy and unhealthy weight[3]. A BMI between 25 and 30 kg/m² is defined as overweight, and a BMI exceeding 30 kg/m² is defined as obesity. Obesity is further classified as class I (BMI 30.0 - 34.9 kg/m²), II (BMI 35.0 - 39.9 kg/m²) and class III (BMI 40 kg/m² or more)[4] obesity. Class III is also referred to as morbid obesity. In addition to causing an excess body weight with consequences for physical appearance, obesity can result in less serious and serious complications and co-morbidities, e.g., cardiovascular, metabolic (diabetes in particular) and orthopaedic[5, 6]. Obesity is further associated with psychological problems such as depression, body dissatisfaction and low self esteem, especially in women and severely obese persons[7-9]. Obese persons are a permanent target of unfavourable opinion, which leads to pervasive discrimination, e.g., in education and job finding[10-12]. Thus, obesity has considerable influence on the patients' health and physical, psychological and social aspects of quality of the life.

The corner stone of conservative therapy in obesity is the reduction of caloric intake combined with increasing physical activity and lifestyle education[13]. Whenever physical activity is added to a programme, weight loss and weight loss maintenance as well as physical and mental aspects of quality of life improve[14-18]. For morbidly obese persons, conservative treatment does not suffice and bariatric surgery is the most successful option[19]. Notwithstanding the success of surgery on weight loss, also for bariatric patients physical activity is important. People who are physically active after obesity surgery experience more weight loss and quality of life improvement[20, 21].

Obesity is generally regarded as the result of a disbalance between energy intake and energy expenditure. Although basically correct, this is too easily translated into 'obese people eat too much and exercise too little', which crudely oversimplifies its aetiology. In addition to nutritional and physical activity habits, genetic, hormonal, psychological, social, economic and environmental factors need to be considered in order to get a correct picture of the aetiological factors that play a role[22]. The human body is not designed for the life most people live nowadays. Our ancestors were frequently confronted with food scarcity and had to engage in high levels of physical activity in order to prevent themselves from starving. Persons who were able to store fat when it was available for

periods of scarcity, more often survived. Their so called 'thrifty genes' were more likely passed to future generations[23-25]. In the last century, the availability of high caloric, easily accessible food increased, whereas the need for strenuous physical activity dramatically decreased. In such an obesogenic environment, persons with 'thrifty genes' – an advantageous characteristic in former times – easily become obese.

This thesis aimed to address psychosocial aspects of the assessment, treatment, and aetiology of obesity. In the first part, the focus is on the assessment of quality of life. The second part is devoted to the position of physical activity in the treatment of obesity. Part one and two both consider the individual suffering from obesity. In part three, the focus is also on the role of the environment.

ASSESSMENT OF QUALITY OF LIFE AND SUFFERING IN OBESITY

Quality of life is a complex and multidimensional concept, and to date its definition is far from clear[26, 27]. It has been defined as someone's position in life in relation to one's goals, expectations, standards, values and cares[28]. This implies that quality of life by definition refers to a subjective concept. Unfortunately, sometimes health status is used as a synonym for quality of life, though health (or functional) status predominantly indicates the extent to which someone's functioning is limited as a result of health problems[29], and not how the patient values this limitation. Despite this lack of consistency in the use of the quality of life definition, its measurement has become increasingly important in the assessment of patient care and research, in addition to clinical tests. Quality of life measures help to identify hidden problems, improve the focus on the treatment of both the patient and the disease, and facilitate communication between the clinician and the patient, thus leading to greater patient satisfaction[30].

The overall aim of the first part of this thesis is to qualify and quantify the influence of obesity on quality of life and suffering, to provide obesity specific reference values of quality of life as assessed by both generic and disease specific instruments, and to develop and evaluate assessment instruments that can be used in clinical practice and research of Dutch speaking obese adults, adolescents, and children.

In chapter 2, a review is given of the quality of life of obese people and specifically of patients who apply for gastric bypass surgery. It is clear from literature that obesity severely affects the life of persons with morbid obesity, especially of those who apply for surgery[31]. An important reason for suffering and perceiving a decreased mental quality of life, is the high extent to which

obese persons are stigmatised, discriminated and rejected[32-35]. Although after bariatric surgery quality of life dramatically improves[36, 37], there are still several problems influencing quality of life that need serious attention of health providers[38-41], e.g., problems resulting from surplus of skin[38], diarrhoea and vomiting[39, 42], or problems resulting from adapting one's life to an entirely new body[40]. Measurement of quality of life in obesity can be achieved by generic and obesity specific measurement instruments. One special problem with the assessment of obesity in bariatric patients is that, after surgery, their weight is often reduced to more normal proportions, which make obesity specific instruments that relate to the effect of body weight, less suitable. Moreover, after surgery specific individual problems influencing quality of life may arise, which are not adequately covered by generic or obesity specific questionnaires. In order to gain a full picture of quality of life in bariatric patients, it is recommended to evaluate quality of life both by a generic and disease specific instrument.

In chapter 3, quality of life of nearly 100,000 obese participants was examined in a meta-analysis focussing on results obtained with two different instruments: a generic instrument (SF-36[29]) and an obesity specific instrument (IWQOL-Lite[43, 44]). This study yielded reference values of quality of life for several treatment groups. The results further demonstrate that in all treatment groups, but most strikingly in the surgical group, quality of life is substantially reduced, and that reductions in mental health cannot be explained by weight alone. Another finding is that quality of life in the large group of non-treatment seeking obesity has hardly been studied, and that treatment seeking is far more prevalent in women, although the prevalence of obesity in men and in women is comparable. There are several explanations for this observation. First, there is empirical evidence that women, as compared to men, suffer disproportionally from their obesity[9, 45, 46], which is a cue for treatment seeking[47, 48]. An alternative explanation for the overrepresentation of women in treatment groups is that women are more concerned about their health, resulting in a stronger motivation to change life style and seek medical help[49, 50]. Finally, weight stigmatisation affects women more than men[33], and thus may also contribute to the higher impact of obesity on quality of life in women and treatment seeking.

In chapter 4 the Pictorial Representation of Illness Self Measure, second revision (PRISM-R2[51, 52]), an instrument designed for measuring suffering, is described and evaluated. Suffering is a concept related to, but not identical with quality of life[52-54]. The PRISM-R2 measures suffering from a disease, e.g., obesity, in a subjective and intuitive manner. It provides an assessment -without the use of words- of the influence of obesity on a person's life. The instrument has pictorial representations of the experienced magnitude of the health problem (three sizes of a red disk), the patient's 'self'

(yellow disk), and the 'current life' of the patient (large circle) (figure 1). The patient is asked to choose and position one of the three red disks somewhere in one's current life (large circle). In this way, the PRISM-R2 yields two quantitative measures: the size of the chosen red disk, called Illness Perception Measure (IPM), and the distance between the centre of the self and the health problem, called Self Illness Separation (SIS).

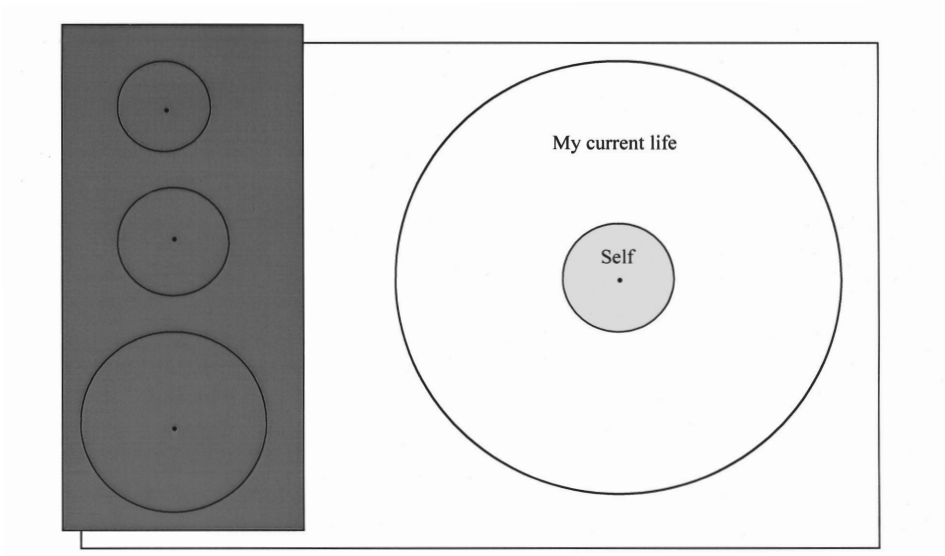

Figure 1: The Pictorial Representation of Illness and Self measure (PRISM); The outer circle represents one's current life, the yellow circle represents one's self, the red circles represent possible representations of the medical problem.

The SIS measure predominantly is an assessment of the patients' perception of the intrusiveness of overweight and the interference of obesity with salient aspects of daily life, whereas the IPM is more representative for the size of the health threat. The PRISM-R2 is a generic instrument, which can be used for several health problems. Therefore, when applied in obesity, it would also be a suitable instrument after body weight has returned to more normal values. This is relevant because obesity, as a chronic health problem, will still affect patients after surgery to some extent, even when the body weight is reduced to a more normal size.

Chapter 5 reports on the translation and validation of a weight related quality of life instrument for adolescents. Currently, there are no obesity specific instruments available in the Netherlands for this group, whereas the prevalence of obesity in Dutch children is about 3%, not much lower than, e.g., the asthma prevalence in children[55, 56] for which several disease specific instruments are

available[57]. The IWQOL-Kids[58] is the first Dutch instrument that can be used for obese adolescents. It was found to be a valid and reliable instrument in a preliminary study among adolescents selected from the general population. The psychometric properties of the Dutch version of the IWQOL-Kids proved to be comparable to those reported for the original American version[58].

A main conclusion of the chapters reviewing and quantifying the influence of obesity on quality of life is that this influence may be considerable. In patients seeking bariatric surgery, quality of life is most seriously impacted[59]. Therefore, in addition to biomedical endpoints such as BMI, blood pressure and diabetes parameters, the accurate assessment of quality of life is mandatory for a complete assessment of the obese patient. The IWQOL instruments and the PRISM-R2 appear useful additions to the tools currently available to clinicians.

PSYCHOLOGICAL DETERMINANTS OF PHYSICAL ACTIVITY IN OBESITY

Treatment in obesity aims at weight reduction, reduction of co-morbidities and improvement of quality of life. Both alterations and reduction of food intake and increase of physical activity are health behaviours that contribute to this goal[14, 16, 18]. Four studies in this thesis focus on physical activity as a component of obesity treatment.

The aim of two prediction studies was to examine the influence of psychological variables (chapter 6 and 7) on the motivation to start and to comply with physical fitness programmes. The aim of two outcome studies was to evaluate the effect of an aquajogging programme on quality of life and relevant physical measures (chapter 8) and to examine the effect of surgical therapy on exercise and exercise health beliefs (chapter 9).

In chapter 6, based on the health belief model[48, 60], health beliefs that could act as a threat, barrier, benefit or cue for taking the step towards being more physically active, were studied in overweight adults, not (yet) suffering from co-morbidities needing medical attention. Sedentary overweight persons were compared to overweight persons who entered a fitness programme. The results show that perceived health benefits of exercise are lower in the non-exercisers, who also more often believe their overweight to be irreversible and attributable to physical causes. Furthermore, in contrast to literature in which embarrassment was the most important barrier in younger adults[61], fear of injury appears to be the most important determinant predictive for their sedentary behaviour. Factors that motivate to start a treatment programme not necessarily also promote compliance with

a programme[62]. Chapter 7 shows that specific psychological factors predict dropout from physical fitness programmes. Different mechanisms may underlie motivation and compliance. Based on the health belief model, low quality of life could be a decisive cue to start treatment. On the other hand, to remain compliant, a relatively high - rather than low - quality of life can help to create the will-power to stay in the programme. In literature psychological factors found to unfavourably affect compliance in behavioural treatment programmes for obesity are indeed lack of self-efficacy, high outcome expectations and low quality of life[63]. In our study, better quality of life and less suffering from obesity were hypothesised to be predictors of compliance to physical training programmes. The results show that less suffering (the SIS measure of the PRISM-R2) and better quality of life (IWQOL-Lite) predict less dropout.

The pilot study described in chapter 8, evaluated aquajogging as a training programme for obesity. Aquajogging has been used for several health problems, especially for those in which the risk for injury is high[64]. Because obese persons might be at a higher risk for injuries[65] and also, as a result of their body weight, do not perceive much pleasure in physical exercise[66], aquajogging seems a suitable form of physical exercise. Although the training period was only six weeks, most of the participants highly valued the programme. Weight loss was minimal, but there was a small but significant decrease in waist circumference and most of the participants perceived better quality of life after the programme. These preliminary results suggest that aquajogging is a suitable exercise intervention in obesity.

In chapter 9 changes in physical activity and exercise cognitions, studied in a group of obese patients subjected to gastric banding (LAGB) surgery, are presented. The changes in physical activity after surgery were large. In addition, moderate to large changes in exercise cognitions were observed one and two years after surgery: participants perceived less embarrassment and fear of injury, more benefits from exercising and more confidence in sportive abilities. Perceiving less exercise benefits and less confidence in sportive abilities before surgery predicted less physical activity two years after surgery. Remarkably, much similar to sedentary overweight adults without co-morbidities, also in bariatric patients after surgery a high fear of injury, predicted physical inactivity in the year to follow. The findings suggest that targeting exercise cognitions before and after surgery might be relevant to improve physical activity.

PSYCHOSOCIAL FACTORS CONTRIBUTING TO THE OBESITY EPIDEMIC

When trying to understand the aetiology of obesity, the focus should not be exclusively on the individual patient. It is also necessary to study the relationship between individual behaviour and the environment, and to consider possible personal moderators and mediators of this behaviour[22, 67, 68].
In chapter 10 the relationship between depressive mood, body weight, and menarche (as a measure of pubertal status) among adolescent girls is explored. In adolescents, and predominantly in adolescent girls, both overweight and depression become more prevalent[69-71]. Studies of overweight and of depression have each evolved from different disciplines[72], although overweight and depression are closely associated in adulthood, especially among women[73-75]. Also, evidence has been provided for time-lagged associations between adolescent overweight and adult depression[76, 77], as well as between adolescent depression and adult overweight[78-80]. Overweight may facilitate the development of depression due to low self-esteem and body dissatisfaction[81]. Conversely, depression may contribute to overweight due to reduced physical activity[82], increased eating[83], reduced self-regulatory strength[84], and low self-efficacy[85]. Moreover, it has been proposed that similar biological mechanisms are involved in both mood regulation and body weight[86], such as predisposing genotypes[72], serotonin[86], leptin[87], and the hypothalamic-pituitary-adrenal system[86]. The purpose of the present study was to find out if one underlying (e.g., hormonal) mechanism can be held responsible for both depression and obesity. We observed only a weak association between depressive mood and body weight and the association was predominantly explained by menarcheal status. This suggests that different mechanisms underlie the post-menarcheal increased prevalence of depression and overweight.
Chapter 11 describes a cross sectional study among adolescent boys and girls. One of the lifestyle factors particularly relevant in this specific age group concerns the consumption of calorie dense snacks and soft drinks[88]. School canteens play a role in the consumption of unhealthy food among adolescents. Availability of snacks at American school has been associated with unhealthier food habits of secondary school pupils, and changing the canteen policy, e.g., by decreasing portion sizes, influenced energy balance in a favourable way[89, 90]. During adolescence, children spend increasingly more time with peers, and their need to belong to a group and to be accepted by peers is higher than during other periods in life[91]. Social learning theory specifies how peers may influence each other by observing and imitating behaviour of important role models in their environment[92]. Group norm setting is also a powerful mechanism in determining an individual's behaviour[93]. Therefore, adolescent peer groups and schools seem important targets for educational purposes

toward healthy behaviour. Our findings demonstrate the close connection between individual consumption patterns of snacks and soft drinks and the consumption of the peer group. Contrary to expectation, but concordant with literature[94], no direct association between school availability of snacks and soft drinks and individual consumption was found, but when an adolescent is attending a school with a lot of snacks, the influence of the peer group on his snacking behaviour seems stronger. This association between individual and peer group snacking was especially strong in boys, lower educated adolescents, and adolescents with a relatively low body weight. Peer groups thus co-determine the snacking behaviour of individual adolescents, in an environment generously providing snacks.

GENERAL DISCUSSION, CLINICAL IMPLICATIONS AND FUTURE RESEARCH

Assessment of quality of life and suffering in obesity

The current thesis significantly contributed to the availability and wider use of quality of life instruments for obese people. First, reference values for obese groups have been generated for the SF-36 and the IWQOL-Lite, allowing comparison between several obesity treatment groups. Second, the translation into Dutch and the preliminary validation of the IWQOL-Kids yielded a weight-related instrument for adolescents to be used for clinical and research purposes. Finally, the further development, psychometric evaluation and application of the PRISM-R2 has contributed to a better insight into the possibilities of this instrument.

Given the well-known limitations of generic measures, it is recommended to use obesity specific instruments in addition to generic instruments. The Impact of Weight on Quality of Life (short version: IWQOL-Lite) is a widely and internationally used, practical and easy to apply instrument for adults with excellent psychometric properties[44, 95-98]. The present thesis made the instrument available in the Dutch language and provided reference values for several treatment groups[59]. The Dutch translation of the IWQOL-Kids and its provisional validation have extended the possibilities of weight related quality of life measurement among Dutch adolescents (age between 11 to 19 years). It addresses specific problems, often encountered by this age group as a result of their overweight. For still younger children, no Dutch instrument is currently available.

The IWQOL-Lite is an obesity-specific and sensitive instrument to document problems specific for obesity, and is responsive to changes due to treatment. On the other hand, it is predominantly

referring to someone's limitations as a result of the overweight problem, and not to one's personal valuation of these limitations. All questions start with 'because of my overweight…' and proceed with problems in the physical, emotional and social domains. In contrast, the PRISM-R2 was not designed as an obesity-specific instrument, and therefore does not tap the obesity specific themes. The advantage of this instrument is that it allows comparison between disease groups and gives a highly personal and intuitive picture of the extent of suffering from a health problem such as obesity, while at the same time facilitating the conversation between the clinician and the patient on relevant (obesity) specific problems.

The use of the proposed combination of instruments offers a more complete and valid picture of the quality of life of the individual obese patient, it facilitates the evaluation of the effect of treatment, and it allows comparisons between disease groups. Future research should further evaluate the psychometric properties of the IWQOL-Kids, especially for adolescents in a clinical setting. The development of a Dutch obesity specific instrument for younger children is also recommended. One possibility is to adapt, translate and validate recently developed American parent-proxy and a child instruments[99, 100]. In addition, it would be interesting to implement and evaluate the PRISM-R2 in overweight and obese children.

Psychological determinants of physical activity in obesity

With respect to physical activity, the main findings of this thesis were the inverse association between fear of injury and physical activity, the promising effects of aquajogging as a low risk exercise programme, and suffering and quality of life as predictors of exercise dropout.

Attitudes toward physical exercise, especially fear of injury, were found to be relevant both in overweigh (but otherwise healthy) adults and in bariatric patients after surgery. Fear of injury can promote the avoidance of physical activity, which in turn can cause exacerbation of the fear[101, 102]. Persons who fear injuries can be helped with adapted training programmes based on gradual activity[103, 104]. Given the role of these fears, careful selection of physical activities for obese persons that are safe and with low risk of injuries is recommended. Aquajogging, a low impact sport used in rehabilitation[105, 106], seems to meet these requirements and has a favourable influence on body composition and fitness[107, 108].

We further demonstrated that obese persons suffering most from their obesity, were also most likely to drop out from exercise programmes. Many obese people have experienced life-long bullying, especially when performing physical exercise at school[109], and most obese persons do not experience much pleasure from physical exercise[66]. Moreover, obese patients report discrimination

and stigmatisation[12], some even by professionals[110]. More awareness of the healthcare giver of the influence of low quality of life on compliance, the implicit stigmatisation of obese patients, together with their fear of injury, will contribute to the design of both effective and sustainable exercise programmes.

In future research, the nature of the fears experienced by overweight persons needs further evaluation. The application of prospective designs, the inclusion of obese persons with co-morbidities, and the use of objective measures of physical activity (e.g., accelerometers) will greatly contribute to clinically relevant knowledge in this area. In addition, the broader application of an aquajogging programme within conservative therapy, as well as after surgical interventions, deserves more attention. The effect of such a programme on physical and mental health outcomes needs further evaluation, preferably in a randomised controlled trial and over a longer period of time.

Psychosocial factors contributing to the obesity epidemic

The two main findings with respect to aetiological factors related to obesity were, first, that depression and obesity could not be contributed to one underlying cause and, second, that several personal and environmental factors determine the snacking behaviour of adolescents.

Depression and obesity did not seem to originate from one underlying mechanism. Although persons with obesity are at risk for developing depression, and persons with depression can develop obesity, it is unlikely that both problems share a common underlying mechanism. This finding may imply that in the treatment of persons with depression and obesity, both problems should be addressed separately, and that successful treatment of one problem not necessarily implies improvement for the other problem as well.

The observation that adolescents show comparable snacking behaviour within a peer group, and that boys, lower educated and normal weight adolescents show stronger peer-group similarities, offers opportunities to design targeted peer group interventions, aimed at stimulating healthy behaviour, comparable to the anti-smoking approach[111]. There is also room for improvement on school availability of healthy food and drinks. When the school availability of high caloric drinks and food decreases, the influence of the peer group on individual consumption of unhealthy snacks and drinks may decrease as well. This is a topic of further investigation, because our cross-sectional design prevented causal inferences to be made, nor is the direction of the association clear: perhaps adolescents influence each others behaviour, but it is also possible that the behaviours of others may play a role in the selection of friends and composition of one's social circle.

Further research is needed to establish the mechanisms underlying depression and obesity. Although there is probably not one mechanism to which both depression and obesity can be attributed, results of long lasting prospective studies considering more complex models can possibly help to explain the co-existence of these two prevalent health problems. With respect to the social and physical environmental factors that contribute to the eating pattern of adolescents, several lines of future research can be suggested. Longitudinal research could analyse the nature of the association of peer group and individual snacking. In addition, experimental research could reveal which responsible processes explain the similarities in the snacking behaviour between individuals and their peer groups.

In conclusion, the present thesis yielded useful new measuring devices, insights and research questions concerning assessment, treatment and aetiology of obesity.

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14

Chapter 14

Summary
Samenvatting (Dutch summary)
Dankwoord (acknowledgement)
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SUMMARY

Obesity is a prevalent chronic health problem that may have a considerable impact on the patients' quality of life. In the last century, the availability of high caloric, easily accessible food increased, whereas the need for strenuous physical activity dramatically decreased. In this obesogenic environment, persons with the genetic ability to store energy – an advantageous characteristic in former times - easily become obese and have to make special efforts to restore the balance. The aim of this thesis was to address psychosocial aspects of the assessment, treatment, and aetiology of obesity. In the first part, the focus was on the assessment of quality of life. The second part was devoted to the position of physical activity in the treatment of obesity. Part three examined amongst others the role of the social environment in the aetiology of obesity.

Assessment of quality of life and suffering in obesity

Quality of life is a complex and multidimensional concept including all domains important to a person, e.g., the physical, social and emotional domains. The assessment of quality of life is important for research and should be an integrated part of clinical assessment, because it offers tools to prioritise problems, to focus on the patient rather than on the disease, and to facilitate communication with the patient, leading to greater patient satisfaction. The overall aim of the first part of this thesis was to qualify and quantify the quality of life and suffering in obesity, to provide reference values for obese groups on quality of life as assessed by both generic and disease specific instruments, and to develop and evaluate assessment instruments that can be used in clinical practice and research of obese populations.

The literature showed that obesity may profoundly affect the life of persons with obesity. Measured with generic and obesity specific instruments, all treatment groups, but most strikingly the surgical group, show highly reduced quality of life scores. Obesity specific instruments more accurately tap themes that are relevant in obesity, and, compared to generic instruments, are more responsive to changes. For adults, the Dutch translation of the Impact of Weight on Quality Of Life, short version (IWQOL-Lite) is currently available, and the adolescent version, the IWQOL-Kids, was translated and provisionally evaluated. In future research, the development of a Dutch obesity specific instrument for younger children is recommended.

An important reason for suffering and perceiving a decreased mental quality of life, is the high extent to which obese persons are stigmatised. Quality of life scores improve after bariatric surgery, but

even then there are still several problems affecting quality of life that need attention of healthcare providers. One special problem with the assessment of obesity in bariatric patients is that, after surgery, their weight is often reduced to more normal proportions, which make obesity specific instruments that relate to the effect of body weight less suitable. The Pictorial Representation of Illness and Self Measure (PRISM) can be useful here. The PRISM measures suffering, a concept related to the quality of life concept. It is a generic instrument, suitable for several health problems. The PRISM gives a personal and intuitive picture of the extent of suffering from a health problem such as obesity, and facilitates the conversation between clinician and patient on relevant (obesity) specific problems. Therefore, when applied in obesity, it would also be applicable after body weight has returned to more normal values.

Psychological determinants of physical activity in obesity

Whenever physical activity is added to a programme, weight loss, weight loss maintenance and physical and mental aspects of quality of life improve. Nevertheless, most overweight persons do not engage in sufficient physical activity. The thesis showed that attitudes toward physical exercise, especially fear of injury, are relevant both in overweigh (but otherwise healthy) adults, and in bariatric patients after surgery. Fear of injury can promote the avoidance of physical activity, which prevents the fear to extinguish and reinforces a sedentary life. Given the role of this fear, careful selection of safe physical activities and psychological support for obese persons is recommended. Aquajogging seems to meet this safety requirement and has a favourable influence on body composition, fitness and quality of life.

Persons suffering most from obesity, were most likely to drop out from our exercise programmes. Many obese people have experienced life-long bullying, especially when performing physical exercise in groups, and most obese persons do not experience much pleasure from physical exercise. Moreover, obese patients report discrimination and stigmatisation, even by professionals. More awareness of the healthcare provider with respect to the influence of low quality of life on compliance, the implicit stigmatisation of obese patients, together with their fear of injury, will contribute to the design of both effective and sustainable exercise programmes.

Psychosocial factors contributing to the obesity epidemic

When trying to understand the aetiology of obesity, the focus should not be exclusively on the individual patient. It is also necessary to study the association between individual behaviour and

the environment, and to consider possible personal moderators and mediators of this behaviour. The first finding with respect to aetiological factors related to obesity was that depression and obesity, both prevalent and concomitant problems in women, could not be attributed to a single underlying cause in adolescent girls. The association between depressive mood and body weight appears weak and is predominantly explained by menarcheal status. This may imply that in the treatment of persons with depression and obesity, both problems should be addressed separately, and that successful treatment of one problem not necessarily implies improvement for the other problem as well. Although there is probably not a single mechanism to which both depression and obesity can be attributed, long lasting prospective studies considering more complex models can possibly help to explain the co-existence of these two prevalent health problems.

Several personal and environmental factors determine the snacking behaviour of adolescents. This thesis showed that peer groups co-determine the snacking behaviour of individual adolescents in an environment generously providing snacks. The connection between the individual consumption patterns and the consumption of the peer group is especially strong in boys, lower educated adolescents, and adolescents with a relatively low body weight. This finding offers opportunities to design targeted peer group interventions, aimed at stimulating healthy behaviour. There is also room for improvement of school availability of healthy food and drinks. Several lines of future research can be suggested. Longitudinal research can analyse the nature of the association of peer group and individual snacking. In addition, experimental research could reveal which responsible processes explain the similarities in the snacking behaviour between individuals and their peer groups.

In conclusion, the present thesis yielded useful new measuring devices, insights and research questions concerning assessment, treatment and aetiology of obesity.

SAMENVATTING (DUTCH SUMMARY)

Obesitas is een veel voorkomend chronisch gezondheidsprobleem dat de kwaliteit van leven behoorlijk negatief beïnvloedt. De beschikbaarheid van calorierijk voedsel is de laatste decennia toegenomen terwijl de noodzaak tot fysieke inspanning fors is afgenomen. In deze zogenaamde obesogene omgeving worden mensen met een genetische aanleg om energie op te slaan -wat voorheen een gunstige eigenschap was- gemakkelijk obees. Zulke mensen moeten extra veel moeite doen om de energiehuishouding in balans te houden.
Dit proefschrift had als doel psychosociale factoren in beeld te brengen die van invloed zijn op assessment, behandeling en ontstaan van obesitas. Het eerste deel richtte zich op kwaliteit van leven. Het tweede deel was gewijd aan het belang van fysieke inspanning bij de behandeling van obesitas. Het derde deel behandelde ondermeer de rol van de sociale omgeving bij het ontstaan van obesitas.

Kwaliteit van leven en lijden bij obesitas

Kwaliteit van leven is een meerdimensionaal concept en bevat alle voor een persoon belangrijke domeinen zoals het fysieke, sociale, en emotionele domein. Het meten van kwaliteit van leven is belangrijk voor onderzoek en voor de klinische praktijk, want het bevordert het boven tafel krijgen van verborgen problematiek en helpt om zich meer te richten op de patiënt, en minder op de ziekte. Daarmee wordt de communicatie tussen hulpverlener en patiënt bevorderd en dit leidt tot groter tevredenheid van de patiënt. Het doel van dit eerste deel was het beschrijven en kwantificeren van kwaliteit van leven en lijden bij obesitas, het genereren van referentiewaarden van generiek en obesitasspecifiek gemeten kwaliteit van leven, en bij te dragen aan de ontwikkeling en evaluatie van meetinstrumenten voor klinische- en onderzoeksdoeleinden.
Uit de literatuur bleek dat obesitas een ernstig nadelige invloed heeft op de kwaliteit van leven. Onafhankelijk van het gebruikte meetinstrument (generiek of obesitasspecifiek), scoren mensen met obesitas laag, in het bijzonder zij die zich aanmelden voor chirurgische behandeling. Obesitasspecifieke instrumenten zijn ontwikkeld om juist die aspecten van kwaliteit van leven die beïnvloed worden door het overgewicht duidelijk in beeld te brengen. Daarmee zijn ze vaak gevoeliger voor verandering dan de generieke vragenlijsten. Voor volwassenen is de Nederlandse vertaling van de Impact of Weight on Quality Of Life, korte versie (IWQOL-Lite) beschikbaar. De versie voor adolescenten (IWQOL-Kids) werd vertaald en voorlopig geëvalueerd. Aanbevolen

wordt om ook voor jongere kinderen een meetinstrument te ontwikkelen.
Dat obese patiënten een verminderde kwaliteit van leven ervaren in het psychische domein, wordt onder andere bepaald door het stigma dat rust op obesitas. Na bariatrische chirurgie verbeteren de scores, maar zelfs na chirurgie zijn er nog diverse problemen aanwezig die de kwaliteit van leven negatief beïnvloeden en aandacht en zorg behoeven. Kwaliteit van leven meten met obesitasspecifieke instrumenten kan problematisch zijn na een operatie als veel gewicht is verloren. De Pictorial Representation of Illness and Self Measure (PRISM) is ook na afvallen nog toepasbaar. Met de PRISM ontstaat, op persoonlijke en intuïtieve wijze, een plaatje van iemands persoonlijke (obesitas) problematiek.

Psychologische determinanten van fysieke activiteit bij obesitas

Alle behandelprogramma's waarin lichamelijke activiteit een rol speelt, hebben een gunstig effect op zowel de fysieke als de mentale aspecten van kwaliteit van leven. Toch zijn maar weinig mensen met overgewicht voldoende fysiek actief. Het bleek dat de houding ten opzichte van fysieke training, vooral angst voor letsel, daarbij een rol speelt. Dit gold zowel voor relatief gezonde volwassenen met overgewicht als voor patiënten na bariatrische chirurgie. Daarom wordt aanbevolen om trainingsprogramma's zorgvuldig te kiezen en patiënten psychologisch te begeleiden. Aquajogging lijkt wat betreft veiligheid een geschikte sport te zijn, met gunstige effecten op het lichaam, de conditie en de kwaliteit van leven.
Deelnemers die het meest leden onder hun overgewicht hielden onze bewegingsprogramma's het minst goed vol. Veel mensen met obesitas zijn hun leven lang gepest vanwege hun overgewicht, vooral bij deelname aan sportactiviteiten en beleven daarom weinig plezier aan fysieke training. Daar komt het obesitas stigma, ook aanwezig onder hulpverleners, nog bij. Het zich bewust zijn van de angst voor letsel, de invloed van slechte kwaliteit van leven en het impliciete stigma rond obesitas, zal de ontwikkeling van effectieve en langdurig vol te houden trainingsprogramma's ten goede komen.

Enkele psychosociale factoren die bijdragen aan de obesitas epidemie

Om iets te begrijpen van het ontstaan van obesitas is het niet voldoende zich alleen te richten op de individuele patiënt. Ook de samenhang tussen het individuele gedrag en de omgeving moet daarbij in ogenschouw genomen worden. De eerste bevinding ten aanzien van etiologische factoren was dat depressiviteit en overgewicht, beide veel en vaak samen voorkomende problemen bij vrouwen,

bij pubermeisjes niet door één onderliggend mechanisme konden worden verklaard. Het verband tussen de twee variabelen bleek zwak en vrijwel volledig toe te schrijven aan de ontwikkelingsfase waarin de meisjes zich bevonden. Dit zou kunnen betekenen dat beide problemen ook apart aandacht verdienen in de behandeling en dat het oplossen van het ene probleem niet automatisch gunstige gevolgen heeft voor het andere probleem. Om te achterhalen hoe het komt dat depressie en obesitas zo vaak samen voorkomen, zijn langdurende observaties in longitudinale studies met aandacht voor complexe biopsychosociale modellen nodig.

De tweede bevinding betrof het snackgedrag van pubers. Dit snackgedrag vertoont grote overeenkomsten met het gedrag in de vriendengroep, vooral als er veel snacks voorhanden zijn op school. Dit gold vooral voor jongens, kinderen in lagere opleidingsniveaus en kinderen die een normaal gewicht hadden. Deze informatie biedt kansen om gerichte interventies te ontwikkelen met als doel om het snackgedrag van de vriendengroep te beïnvloeden. Ook aanpak van het aanbod in schoolkantines lijkt zinvol. Voor toekomstig onderzoek biedt dit diverse ideeën: het verband tussen de vriendengroep en het individu kan nader worden geanalyseerd in prospectief onderzoek en in experimenteel onderzoek kan meer licht worden geworpen op de aard van de overeenkomsten in snackgedrag binnen vriendengroepen.

Samengevat bood dit proefschrift enkele nieuwe meetinstrumenten, inzichten en onderzoeksvragen met betrekking tot assessment, behandeling en etiologie van obesitas.

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Eveline
Eindhoven, december 2009

CURRICULUM VITAE

Eveline Wouters was born January 15th, 1958 in Eindhoven. After completing secondary education (gymnasium Augustinianum Eindhoven) in 1975, she studied Medicine at Utrecht University. In her first job as a physician at the department of obstetrics and gynaecology of the Catharina Hospital in Eindhoven, she combined clinical work and research, one of her research subjects being the influence of pregnancy smoking on the neonate. During that time, she also started teaching at the nursing school of the hospital. In 1989 she started to work as a lecturer at the Fontys University of Applied Sciences, department of Physiotherapy. Part of her teaching consisted of the supervision of graduation theses. At the end of 2005, she started research on quality of life in obesity, which resulted in this Ph.D. project. Since its foundation in January 2008, she participates and conducts research in the Fontys chair 'health care and technology for quality of life'. From March 2009 onward, she also supervises master theses at the Physician Assistant Clinical Midwifery department of the Rotterdam University of Applied Sciences. In 2009, she obtained her masters degree Public Health, epidemiology, at Maastricht University.

Eveline Wouters werd op 15 januari 1958 geboren in Eindhoven. Na de middelbare school (gymnasium Augustinianum Eindhoven) in 1975, ging ze geneeskunde studeren aan de Universiteit Utrecht. In haar eerste baan als arts combineerde ze klinisch werk met onderzoek op de afdeling verloskunde en gynaecologie van het Catharina ziekenhuis in Eindhoven. Een van haar onderzoeksonderwerpen was de invloed van roken tijdens de zwangerschap op de pasgeborene. In die tijd begon ze ook met lesgeven aan de in service verpleegkunde opleiding van het ziekenhuis. In 1989 is ze gestart met haar huidige werk aan de Fontys Paramedische Hogeschool in Eindhoven. Ze verzorgt daar medisch en wetenschappelijk onderwijs en begeleidt afstudeerprojecten. Eind 2005 werd een begin gemaakt van het onderzoek naar obesitas en kwaliteit van leven. Sinds de oprichting in januari 2008 is ze lid van en onderzoeker in de kenniskring van het Fontys lectoraat 'health care and technology for quality of life'. Vanaf maart 2009 is ze ook begeleider van afstudeeronderzoek aan de masteropleiding Physician Assistant klinisch verloskundige aan de Hogeschool Rotterdam. In 2009 behaalde ze haar master diploma Public Health, epidemiologie, aan de Universiteit Maastricht.

PUBLICATIONS

Scientific publications

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